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TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION

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Institute of Science and Technology
The University of Michigan
Ann Arbor, Michigan

Air Force Avionics Laboratory
Research and Technology Division
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

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NOTICES

Sponsorship. The work reported herein was conducted by the Willow Run Laboratories of the Institute of Science and Technology for the Air Force Avionics Laboratory, Wright-Patterson Air Force Base, Ohio, under Contract F33615-67-C-1293 (continuation of Contracts AF 33(657)-10974 and AF 33(615)-3654). Contracts and grants to The University of Michigan for the support of sponsored research are administered through the Office of the Vice-President for Research.

January 1969

NOTE TO USERS

Target Signature Analysis Center: Data Compilation is a periodically updated publication of the optical and microwave target and background data stored on magnetic tape at the Target Signature Analysis Center established at The University of Michigan and sponsored by the Air Force Avionics Laboratory. Separate volumes are maintained for classified and unclassified data. The compilation is distributed in loose-leaf form so that supplemental publications can be readily integrated in accordance with the established indexing system. The complete publication history of the Target Signature Analysis Center: Data Compilation is summarized in the foreword to the enclosed document.

This present document is the fourth publication of unclassified data and the eighth publication in the overall compilation. It consists of optical data, revised explanatory text, and composite cross indexes, and is meant to be integrated with the previous unclassified publications. The following suggestions are made for revising the existing unclassified Data Compilation and adding the enclosed material.

(1) Remove and destroy previously published cover, Notices, and all front matter (dated August 1968). Insert corresponding new pages, supplied herewith.

(2) Remove and destroy all numbered text pages and Distribution List (dated August 1968 or earlier) from the previously integrated compilation (pp. 1 through 72).

(3) Insert new section 1 (Introduction, pp. 1-1 through 1-11).

(4) Insert new section 2 (Cumulative Subject Cross Index, pp. 2-1 through 2-9).

(5) Insert new text for section 3 (Optical Spectral Data, pp. 3-1 through 3-46). Following p. 3-46, insert optical data sheets and dividers AA through CJ from previous compilations.

(6) Following p. CJ-14, insert new text for section 4 (Optical Reflectance Distribution Function Data, pp. 4-1 through 4-17), followed by the enclosed reflectance distribution data sheets.

(7) Following p. (f)CJA 25, insert new text for section 5 (Radar (Active Microwave) Data, pp. 5-1 through 5-10). Following p. 5-10, insert radar data sheets and dividers from preious compilations.

(8) Insert new text for section 6 (Passive Microwave Data, pp. 6-1 through 6-3). Following p. 6-3, insert passive microwave data sheets from previous compilations.

(9) Insert new distribution list.

(10) Remove and destroy DD Form 1473, and replace it with the new page supplied herewith.

January 1969

TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION

Seventh Supplement

Dwayne Carmer

January 1969

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of AFAL (AVPT), WPAFB, Ohio.

FOREWORD

This is the eighth publication overall and the fourth unclassified publication of the Target Signature Analysis Center: Data Compilation (July 1966). It was prepared at the Willow Run Laboratories, a unit of The University of Michigan's Institute of Science and Technology. The preparation was begun under Air Force Contract AF 33(657)-10974 and continued under Contracts AF 33(615)-3654 and F33615-67-C-1293. The originator's report number is 8492-35-B. The work was administered under the direction of the Air Force Avionics Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, with Mr. Bruno K. Wernicke as the project engineer.

Dwayne Carmer is author of this supplement, under the direction of Howard Courtney, Principal Investigator. The author gratefully acknowledges the assistance of Glenn Curtis, who was responsible for processing the data included with the present in this revision. Contributors to previous supplements include Dianne Earing, Dr. I. W. Ginsberg, Elmer Haag, and Jerry Beard.

PUBLICATION HISTORY OF THE TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION

Report	Author	Date	WRL Report No.	AD Number (DDC)
Unclassified Publications				
Original Compilation	Dianne Earing James A. Smith	July 1966	7850-2-B	AD 489 968
Second Supplement	Dianne Earing	July 1967	8492-5-B	AD 819 712
Fifth Supplement	Dianne Earing	August 1968	8492-15-B	AD 840 091
Seventh Supplement	Dwayne Carmer	January 1969	8492-35-B	-
Classified Publications				
First Supplenent	Dianne Earing	December 1966	7850-9-B	AD 379 650
Third Supplement	Dianne Earing	October 1967	8492-12-B	AD 384 874
Fourth Supplement	Dianne Earing Elmer Haag	December 1967	8492-14-B	AD 391 239
Sixth Supplement	Dianne Earing	November 1968	8492-25-B	AD 394 783
Eighth Supplement	Dwayne Carmer	January 1969	8492-43-B	-

ABSTRACT

This supplement to the Target Signature Analysis Center: Data Compilation augments an ordered, indexed compilation of reflectances, radar cross sections, and apparent temperatures of target and background materials. The Data Compilation includes spectral reflectances and transmittances in the optical region from 0.3 to 15 μ and normalized radar cross sections (active) and apparent temperatures (passive), plotted as functions of aspect or depression angle, at millimeter wavelengths. When available, the experimental parameters associated with each curve are listed to provide the user with a description of the important experimental conditions.

This supplement contains the initial addition of reflectance distribution function data to the unclassified compilation. The data are presented in tabular form as a function of reflection angle for fixed incidence angles and discrete wavelengths in the visible and near-infrared spectral regions. These data were obtained from the Laboratory Measurements Phase of the Target Signature Measurements Program conducted at The University of Michigan and sponsored by the Air Force Avionics Laboratory. The unclassified compilation, including these data, consists of about 4300 curves and 112 tables (in general, each table is the equivalent of four unique curves).

January 1969

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TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION
Seventh Supplement

1
INTRODUCTION

The Target Signature Analysis Center established at the Willow Run Laboratories of The University of Michigan's Institute of Science and Technology and sponsored by the Air Force Avionics Laboratory comprises a document collection, a data library, and a staff of analysts. It provides a centralized source of data and analysis techniques useful for improving remote sensors. The routine functions of the Center include collecting, evaluating, and categorizing data on the properties of various target and background objects. In the optical portion of the electromagnetic spectrum from 0.3 to 15 μ, the data are primarily on reflectance and transmittance; at microwave frequencies, they consist of normalized radar cross sections (active) and apparent temperatures (passive). The primary source of data is reports published by laboratories making such measurements. In some instances, unpublished data have also been acquired directly from an experimenter.

Each document received by the Analysis Center is examined for data to be added to the library. Selected data are then manually digitized using an established format. Coded descriptors are assigned to each curve for retrieval purposes, and the conditions of each experiment are recorded. Data points and the descriptive and parametric information are also stored on magnetic tape. Since the parameters required to define radar measurements differ in many respects from those required for optical measurements, separate formats were designed to handle the different types of information. However, a general format has recently been devised and will eventually be used for all data. This new format is discussed in section 6 and has been used for processing the passive microwave data.

Optical ($0.3 < \lambda < 1000$ μ) and microwave ($\lambda > 1000$ μ) instruments were used to obtain the data reported here; the experiments were conducted during the last three decades. Three types of measurements are represented:

(1) Laboratory measurements of materials such as leaves, soil, and paints
(2) Ground-based field measurements of objects such as plants, soil plots, and vehicles
(3) Airborne measurements of scenes

In the optical portion of the spectrum, laboratory measurement programs are far more abundant than either ground-based field measurements or airborne measurement programs. In the microwave region, field and airborne instrument measurements predominate. There

is a much larger amount of data on background materials (e.g., leaves, crops, and soils) than on man-made materials. The reason is that most of the past measurements were performed by scientists in the fields of botany, agronomy, and natural science, and, therefore, the primary motivation for these measurements was an interest in natural objects.

This data compilation is the product of a survey of existing data on target and background materials and is intended to present the results of such a survey in a single source. The picture it presents of natural and man-made objects in the real world and their interaction with electromagnetic radiation is in no way complete. Although many data have been gathered on some materials and at a few wavelengths, data are completely lacking for other materials and other wavelengths. Moreover, even the existing data are not accompanied with all the parametric and support information required for their adequate interpretation. The extensive Target Signature Measurements Program currently sponsored by the Air Force Avionics Laboratory is planned to fill existing data gaps. This program provides for laboratory and field measurements of target and background materials and objects at both optical and microwave frequencies. In the optical region, bidirectional and directional reflectances are under investigation. In the microwave region, optical simulation studies are being conducted, and existing radiometric (passive) data are being collected. Some of the data from this program, specifically reflectance data in the 0.3- to 2.5-μ spectral interval and reflectance distribution data at laser wavelengths are included in this compilation.

Only unclassified data from the Target Signature Analysis Center's collection are included in this supplement. The classified data have been published separately and are referenced in the foreword to this publication. Each data curve or data table has been assigned alphabetic descriptor codes to describe the object measured, the instrumentation used, the optical property measured, and the spectral interval employed. An alphabetically arranged list of these codes is given in table 1-1. The data curves in this publication have been grouped according to the coded descriptor that best describes the object measured. This prime descriptor, a page number, and the common name(s) of the objects are arranged as a cross index in section 2, which will be revised as future supplements are published, thus making it cumulative.

Section 3 contains optical spectral data as well as (a) a theoretical treatment of reflectance, (b) a description of some of the instruments used to collect these data, and (c) a summary of experiments yielding optical spectral data. The data sources in the TSAC collection are listed with the experiments included in the summary; the additional references also noted there are listed in section 3.6, which cites the literature sources for all of section 3. Section 3 is thus self-contained, to facilitate future additions to the compilation.

Section 4 contains optical data of the bidirectional reflectance or reflectance distribution function type. Although covered conceptually in section 3, a definition of the reflectance distribution function is given in section 4 along with some equations for the application of such data and a description of the instruments used for data collection. Section 4.5 lists the literature sources for this material.

Section 5 contains active microwave data of two types: averaged normalized radar cross sections as a function of aspect angle, with frequency as a parameter, and cumulative probability distribution vs. radar cross section. The curves are grouped according to the type of object measured. Instrumentation and TSAC literature sources comprise section 5.3; again, section 5 is thus self-contained.

Section 6 contains passive microwave data and a generalized parameter list that is part of an expanded version developed from the parameter system used in sections 3 and 4. Later data compilations will make use of this generalized list.

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST

Code	Subject
A	TARGETS
AA	Ground
AAA	Buildings
AAAA	Steel
AAAB	Brick, Stone, Concrete
AAAC	Wood Frame
AAAD	Stick Huts
AAAE	Mud Huts
AAB	Guns
AABA	Artillery
AABB	Rifles
AAC	Industrial Facilities
AACA	Power Stations
AACB	Shipyards
AAD	Military Facilities
AADA	Communication Centers
AADB	Fortifications
AADC	Launching Sites
AADCA	Antiaircraft
AADD	Marshalling Yards
AADE	Supply Depots
AAE	Airfields
AAF	Railroad
AAFA	Tracks
AAFB	Yards
AAG	Roads
AAH	Bridges
AAI	Dams
AAJ	Locks
AAK	Personnel
AAKA	Clothing
AAKAA	Cotton Fibers (Cellulose)
AAKAB	Synthetic Fibers
AAKAC	Wool Fibers
AAKAD	Noncloth Items
AAKB	Troop Concentrations
AAKC	Skin
AAKCA	Asiatic
AAKCB	Caucasian
AAKCC	Negro
AAL	Vehicles
AALA	Aircraft
AALB	Armored
AALC	Convoys
AALD	Earth-Moving
AALE	Tanks
AALF	Trucks
AB	Marine
ABA	Submarine
ABB	Surface Vessels
ABBA	Barges
ABBB	Landing Craft
AC	Camouflage
AD	Decoys
AE	Materials
AEA*	Aluminum
AEB	Asphalt
AEC	Brick
AED	Burlap
AEE	Canvas
AEF	Cinder
AEG	Concrete
AEH	Dirt
AEI*	Galvanized Steel
AEJ	Glass
AEK	Gravel
AEL	Metal
AELA	Aluminum
AELB	Brass
AELC	Bronze
AELD	Copper
AELE	Steel
AELEA	Galvanized
AELEB	Stainless
AEM	Paint
AEMA	White Pigments
AEMAA	Zinc Oxide (Zinc White)
AEMAB	Lead Basic Carbonate (White Lead)
AEMAC	Titanium Dioxide
AEMB	Green Pigments
AEMBA	Chromic Oxide (Chrome Green)
AEMC	Red Pigments
AEMCA	Ferric Oxide (Hematite)
AEMCB	Trilead Tetroxide (Red Lead)
AEMD	Metallic Pigments
AEMDA	Aluminum Powder
AEME	Other Pigments (Color Unknown)
AEMEA	Mica
AEMEB	Aluminum Silicate
AEMF	Mediums, Thinners, Driers
AEMFA	Resin
AEMFAA	Oleo
AEMFAB	Alkyd
AEMFB	Ester
AEMFC	Xylene
AEMG	Primer
AEN	Paper/Cardboard
AEO	Plastic
AEP	Rubber
AEQ	Tar
AER	Tile
AES	Varnish
AET	Wood
AF	Radiation Control
AFA	Antireflection Coating

*Not being used in the present system.

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

AFB	Shielding
AFC	Temperature Control
AG	Signatures
AH	Geometric Shapes
AHA	Flat Plates
AHB	Dihedrals (Concave)
AHC	Trihedrals (Concave)
AHD	Spheres and Spheroids
AHE	Cylindrical Shapes
AHF	Conical Shapes
AHG	Wedges
AHH	Dipoles
AHI	Rayleigh Scatters
AHJ	Other
AI	Contaminants
AIA	Corrosion
AIB	Dew
AIC	Dirt
AID	Dust
AIE	Oxide
AIF	Rust
AIG	None Visible
B	BACKGROUNDS
BA	Atmosphere
BAA	Constituents
BAAA	Aerosols
BAAB	Dust
BAAC	Fog
BAAD	Gases
BAAE	Haze
BAAF	Rain
BAAG	Smog
BAAH	Smoke
BAAI	Snow
BAAJ	Spray
BAAK	Water Vapor
BAB	Sky
BB	Clouds
BBA	Cumulonimbus
BBB	Cirrus
BBC	Cirrocumulus
BBD	Cirrostratus
BBE	Altocumulus
BBF	Altostratus
BBG	Cumulus
BBH	Nimbostratus
BBI	Stratocumulus
BC	Light Conditions
BCA	Day
BCB	Sunrise or Sunset
BCC	Twilight
BCD	Night
BCE	Clear
BCF	Overcast
BD	Season
BDA	Summer
BDB	Fall
BDC	Winter
BDD	Spring
BE	Terrain Uniformity
BEA	Flat
BEB	Rolling
BEC	Hilly
BED	Mountainous
BEE*	Rural
BEF*	Urban
BF	Soil
BFA*	Cultivated
BFB*	Uncultivated
BFC	Coarse Textured
BFCA	Sand
BFCB	Loamy Sand
BFD	Moderately Coarse Textured
BFDA	Sandy Loam
BFDB	Fine Sandy Loam
BFE	Medium Textured
BFEA	Loam
BFEB	Silt Loam
BFEC	Silt
BFF	Moderately Fine Textured
BFFA	Clay Loam
BFFB	Sandy Clay Loam
BFFC	Silty Clay Loam
BFG	Fine Textured
BFGA	Sandy Clay
BFGB	Silty Clay
BFGC	Clay
BFH	Other Constituents
BFHA	Organic Material
BFHB	Gravel (Less Than 3-in. Diameter)
BFHC	Cobbles (3- to 10-in. Diameter)
BFHD	Stones (Greater Than 10-in. Diameter)
BFHE	Bedrock
BFHF	Salt
BFI	Series
BFIA	Aguan
BFIB	Aiken
BFIC	Akron
BFID	Alamance
BFIE	Albion
BFIF	Alonso
BFIG	Barnes
BFIH	Blakely
BFII	Clareville

*Not being used in the present system.

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

BFIJ	Clarion
BFIK	Collington
BFIL	Colts Neck
BFIM	Decatur
BFIN	Dublin
BFIO	Gooch
BFIP	Grady
BFIQ	Greenville
BFIR	Guthrie
BFIS	Hainamanu
BFIT	Hall
BFIU	Hamakua
BFIV	Herradura
BFIW	Joplin
BFIX	Marias
BFIY	Marshall
BFIZ	Matanzas
BFJ	Series (Continued)
BFJA	Maury
BFJB	Moaula
BFJC	Naalehu
BFJD	Onomea
BFJE	Ookala
BFJF	Orangeburg
BFJG	Oriente
BFJH	Orman
BFJI	Pallman
BFJJ	Penn
BFJK	Pierre
BFJL	Putnam
BFJM	Quibdo
BFJN	Rubicon
BFJO	Ruston
BFJP	Santa Barbara
BFJQ	Texas Dune
BFJR	Tifton
BFJS	Tillman
BFJT	Tilsit
BFJU	Vernon
BFJV	Weld
BFJW	Windthorst
BFJX	Yolo
BFJY	Zanesville
BFK	Minerals
BFL	Chemicals
BFM	Moisture Content
BFMA	Dry
BFMB	Damp
BFMC	Saturated
BG	Vegetation
BGA	Herbaceous, Algae Fungi
BGAA	Cladoniaceae Family
BGAAA	Reindeer Moss
BGB	Moss-Liverwort
BGBA	Sphagnum Family
BGBAA	Sphagnum Moss
BGC	Vascular
BGCA	Banana Family
BGCAA	Banana
BGCB	Bromeliaceae Family
BGCBA	Bunch Grass
BGCC	Buckwheat Family
BGCCA	Buckwheat
BGCD	Composite Family (cf. Ligneous)
BGCDA	Daisy
BGCDB	Goldenrod
BGCDC	Ragweed
BGCDD	Sunflower
BGCE	Convolvulus Family
BGCEA	Sweet Potato
BGCF	Crowfoot Family
BGCFA	Crowfoot
BGCG	Duckweed Family
BGCGA	Duckweed
BGCH	Evening-Primrose Family
BGCHA	Willow Herb (cf. Willow Family)
BGCI	Fern Family
BGCIA	Bracken Fern
BGCJ	Flax Family
BGCJA	Flax
BGCK	Goosefoot Family
BGCKA	Pigweed
BGCKB	Sugar Beet
BGCL	Gourd Family
BGCLA	Squash
BGCM	Grass Family
BGCMA	Barley
BGCMB	Bermuda Grass
BGCMC	Corn
BGCMD	Creeping Grass
BGCME	Fescue
BGCMF	Foxtail
BGCMG	Ilyas
BGCMH	Millet
BGCMI	Oats
BGCMJ	Reeds
BGCMK	Rice
BGCML	Rye
BGCMM	Selin
BGCMN	Timothy
BGCMO	Vetch
BGCMP	Wheat
BGCN	Heath Family (see also Ligneous)
BGCNA	European Blueberry
BGCNB	Heather
BGCO	Mallow Family
BGCOA	Cotton

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

BGCP	Mustard Family
BGCPA	Cabbage
BGCPB	Mustard
BGCQ	Nightshade Family
BGCQA	Potatoes
BGCQB	Tomatoes
BGCR	Pea (or Pulse) Family (see also Ligneous)
BGCRA	Alfalfa
BGCRB	Clover
BGCRC	Coffee Plant
BGCRD	Lentil
BGCRE	Lima Bean
BGCRF	Pea
BGCRG	Peanut
BGCRH	Soybean
BGCRI	String Bean
BGCS	Plantain Family
BGCSA	Plantain
BGCT	Sedge Family
BGCTA	Cotton Grass
BGCTB	Sedge
BGD	Ligneous
BGDA	Arecaceae Family
BGDAA	Areca Palm
BGDB	Beech Family
BGDBA	Beech
BGDBB	Chestnut
BGDBC	Oak
BGDC	Bignonia Family
BGDCA	Catalpa
BGDD	Calycanthaceae Family
BGDDA	Meratia Praecox
BGDE	Carduacea Family
BGDEA	Rabbit Brush
BGDF	Cashew Family
BGDFA	Chinese Pistachio
BGDFB	Sumach
BGDG	Composite Family (cf. Herbaceous)
BGDGA	Sagebrush
BGDGB	Wormwood
BGDH	Dogwood Family
BGDHA	Dogwood
BGDI	Ebony Family
BGDIA	Ironwood (cf. Hazel Family)
BGDIB	Persimmon
BGDJ	Elm Family
BGDJA	Elm
BGDK	Figwort Family
BGDKA	Paulowina
BGDL	Hazel Family
BGDLA	Alder
BGDLB	Birch
BGDLC	Hazelnut
BGDLD	Hornbeam
BGDLE	Ironwood (cf. Ebony Family)
BGDM	Heath Family (cf. Herbaceous)
BGDMA	Mountain Laurel
BGDN	Holly Family
BGDNA	Holly
BGDO	Honeysuckle Family
BDGOA	Viburnum
BGDP	Laurel Family
BGDPA	Laurel
BGDPB	Sassafrass
BGDQ	Lily Family
BGDQA	Yucca
BGDR	Linden Family
BGDRA	Basswood
BGDRB	Linden
BGDS	Logania Family
BGDSA	Privet (Ligustrum)
BGDT	Magnolia Family
BGDTA	Magnolia
BGDTB	Tulip
BGDTC	Tulip Poplar
BGDU	Maple Family
BGDUA	Maple
BGDV	Mulberry Family
BGDVA	Rubber
BGDW	Olive Family
BGDWA	Ash
BGDX	Pine Family
BGDXA	Cedar
BGDXB	Fir
BGDXC	Juniper
BGDXD	Larch
BGDXE	Pine
BGDXF	Spruce
BGDY	Plane-Tree Family
BGDYA	Sycamore
BGDZ	Pea Family (cf. Herbaceous)
BGDZA	Locust
BGE	Ligneous (Continued)
BGEA	Rose Family
BGEAA	Blackberry
BGEAB	Cherry
BGEAC	Hawthorn
BGEAD	Juneberry
BGEAE	Peach
BGEAF	Pin Cherry
BGEAG	Plum
BGEB	Sour Gum Family
BGEBA	Gum
BGEC	Trumpet-Creeper Family
BGECA	Calabash

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

BGED	Vine Family
BGEDA	Virginia Creeper
BGEE	Walnut Family
BGEEA	Hickory
BGEF	Willow Family
BGEFA	Aspen
BGEFB	Poplar
BGEFC	Willow (cf. Evening Primrose Family)
BGEFCA	Dwarf
BGEFCB	Ground
BGEG	Witch Hazel Family
BGEGA	Sweet Gum
BGF	Leaf
BGFA	Narrow
BGFB	Broad
BGFBA	Coriaceous (Leathery)
BGFBB	Membranous
BGFBC	Lower Leaf Surface
BGFBD	Upper Leaf Surface
BGFC	Young (Spring)
BGFD	Mature (Summer)
BGFE	Old (Fall)
BGFF	Dry
BGG	Bark
BGH	Twig
BH	Water
BHA	Formations
BHAA	Lake
BHAB	Puddle
BHAC	River
BHAD	Sea
BHB	State
BHBA	Ice
BHBB	Ice and Liquid
BHBC	Liquid
BHBD	Snow
BI	Climate
BJ	Composite Backgrounds
BJA	Urban
BJAA	Villages
BJAB	Towns
BJAC	Cities
BJB	Rural-Uncultivated
BJBA	Jungle
BJBB	Forest
BJBC	Grassplains
BJBD	Marsh
BJBE	Tundra
BJBF	Desert
BJC	Rural-Cultivated
BJCA	Orchard
BJCB	Bushes and Shrubs
BJCC	Plowed Fields
BJCD	Pasture or Grain
BJCE	Rice Paddy
C	EQUIPMENT
CA	Radar
CAA	Coherent
CAB	Noncoherent
CAC	Pulse
CAD	CW
CAE	MTI
CAF	Resolution Limited by Antenna
CAG	Synthetic Aperture
CB	Radiometer
CBA	Optical (Wavelength Less Than 1000 μ)
CBB	Microwave (Wavelength Greater Than or Equal to 1000 μ)
CBBA	Unmodulated
CBBB	Post-Detection Modulated
CBBC	Signal Modulated
CBBD	Cross Correlated
CBBE	Two-Channel Subtraction
CC	Spectrograph
CCA	Eastman Kodak
CD	Spectrometer
CDA	Beckman
CDAA	Model DU
CDAB	Model DK-1
CDAC	Model DK-2
CDAD	Microspec
CDB	General Electric
CDC	Perkin-Elmer
CDCA	Model 12
CDCB	Model 21
CDD	Interference
CDE	Cary
CDEA	Model 14
CDEB	Model 90
CE	Platform
CEA	Aircraft
CEB	Balloon
CEC	Ground
CED	Laboratory
CEE	Shipborne
CF	Optical
CFA	Ultraviolet
CFB	Visible
CFC	Infrared
CFD	Active
CFE	Passive
CG	Detectors
CH	Filters
CI	Image Tubes
CJ	Materials

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

CJA	Reflectance Standards (Optical)
CJAA	Magnesium Oxide
CJAAA	Smoked
CJAAB	Pressed
CJAB	Magnesium Carbonate
CJAC	Sulphur
CJAD	Aluminum
CJADA	Mirror
CJADB	Sandblasted
CJAE	Sapphire Felt
CJAF	Other Specular Standards
CJAG	Other Diffuse Standards
CJB	Reflectance Standards (Microwave)
CJBA	Metallic Sphere
CJBB	Luneberg Reflector
CJBC	Corner Reflector
CK	Evaluation
CKA	Noise
CL	Reflectometer (Bidirectional)
CLA	EGR
CLB	PGR
CM	Polarimeter
D	RADIATION
DA	Pattern
DAA	Aspect Dependence
DAB	Optical Cross Section
DAC	Radar Cross Section (σ)
DACA	Normalized (σ_0)
DB	Attenuation
DBA	Absorption
DBB	Scatter
DBBA	Backscatter Coefficient (ρ)
DC	Modulation
DD	Polarization
DDA	Radar
DDAA	Circular
DDAAA	Right
DDAAB	Left
DDAB	Elliptic
DDABA	Right
DDABB	Left
DDAC	Linear
DDACA	Horizontal or Perpendicular
DDACB	Vertical or Parallel
DDACC	Oblique
DDACCA	Cross-Polarized
DDACCB	Parallel-Polarized
DDAD	Random
DDB	Optical
DDBA	Circular
DDBAA	Right
DDBAB	Left
DDBB	Elliptic
DDBBA	Right
DDBBB	Left
DDBC	Linear
DDBCA	Perpendicular
DDBCB	Parallel
DDBD	Random
DE	Refraction
DF	Reflectance
DFA	Directional
DFAA	Specular Included
DFAB	Specular Not Included
DFB	Specular
DFC	Standard
DFCA	Baryte
DFCB	Flowers of Sulfur
DFCC	Gypsum
DFCD	Magnesium Carbonate
DFCE	Magnesium Oxide
DFCF	Paper
DFCG	Rhodium Mirror
DFCH	Aluminum Mirror
DFD	Bidirectional
DFE	Total (Albedo)
DFF	Absolute
DG	Scintillation
DH	Solar Influence
DI	Transmittance
DIA	Directional
DIB	Bidirectional
DJ	Emission
DJA	Atmosphere
DJB	Emissivity
DJC	Emittance
DJD	Blackbody
DJE	Greybody
DJF	Fluorescence
DJG	Thermal
DK	Artificial Sources
DKA	Arc
DKB	Beacon
DKC	Flame
DKD	Flare
DKE	Gas
DKF	Gas Discharge
DKG	Globar
DKH	Incandescent Lamp
DKI	Maser, Laser, Iraser, Uvaser
DKJ	Mantle
DKK	Nernst Glower
DKL	Nuclear Explosion
DKM	Oscillator
DKN	Shock Tube
DKO	Spark
DKP	Vapor Lamp
DKQ	Monochromator

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

DL	Natural Sources
DLA	Aurora
DLB	Airglow
DLC	Lightning
DLD	Lunar
DLE	Planetary
DLF	Solar
DLG	Stellar
DLH	Zodiacal Light
DLI	Sky
DM	Flux
DN	Radiance
DO	Coherence
DP	Diffraction
DQ	Apparent Temperature
DQA	Antenna
DQB	Target
DQC	Contrast
E	SPECTRA
EA	Gamma Rays
EB	X-Rays
EC	Optical
ECA	Ultraviolet
ECAA	Less than 0.1 μ
ECAB	0.1 to 0.2 μ
ECAC	0.2 to 0.3 μ
ECAD	0.3 to 0.4 μ
ECB	Visible (0.4 to 0.7 μ)
ECBA	Chromaticity
ECBB	Color
ECBBA	Blue
ECBBB	Green
ECBBC	Yellow
ECBBD	Orange
ECBBE	Red
ECBBF	Brown
ECBBG	Field Drab
ECBBH	Khaki
ECBBI	Olive Drab
ECBBJ	White
ECBBK	Grey
ECBBL	Black
ECC	Infrared
ECCA	0.7 to 1.5 μ
ECCB	1.5 to 3.0 μ
ECCC	3 to 5 μ
ECCD	5 to 8 μ
ECCE	8 to 15 μ
ECCF	15 to 50 μ
ECCG	50 to 100 μ
ECCH	100 to 1000 μ
ECCI	1.4-μ band

ECCJ	1.9-μ band
ECCK	2.2-μ band
ECCL	2.7-μ band
ECCM	4.3-μ band
ECCN	6.3-μ band
ECCO	9.6-μ band
ECCP	Other
ECD	Line
ED	Radio Frequency
EDA	EHF (30 to 300 GHz)
EDAN	V Band (46 to 56 GHz)
EDAQ	Q Band (36 to 46 GHz)
EDAT	Upper K_a Band (30 to 36 GHz)
EDB	SHF (3 to 30 GHz)
EDBF	Lower K_a Band (20.9 to 30 GHz)
EDBJ	K_u Band (10.9 to 20.9 GHz)
EDBM	X Band (5.2 to 10.9 GHz)
EDBP	Upper S Band (3.0 to 5.2 GHz)
EDC	UHF (0.3 to 3 GHz)
EDCE	Lower S Band (1.55 to 3.0 GHz)
EDCH	L Band (0.39 to 1.55 GHz)
EDCK	P Band (2.25 to 3.90 GHz)
EDD	VHF (30 to 300 MHz)
EDE	HF (3 to 30 MHz)
EDF	MF (0.3 to 3 MHz)
EDG	LF (30 to 300 kHz)
EDH	VLF (3 to 30 kHz)
F	OPERATIONS
FA	Detection
FB	Discrimination
FC	Reconnaissance
FD	Surveillance
FE	Imaging
FEA	Photography
FEB	Scanning
FEC	Contrast
FED	Resolution
FEE	Display
FF	Filtering
FFA	Spatial
FFB	Spectral
FG	Measurement
FGA	Temperature
FGB	Time
FGC	Position
FGD	Range
FGE	Angle
FGF	Velocity

TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Concluded)

FGG	Acceleration
FH	Calibration
FI	Homing
FJ	Pattern Recognition
G	ANALYSIS
GA	Mathematical
GAA	Model
GB	Statistical
GBA	Distribution
GBAA	Gaussian
GBB	Process
GBBA	Ergodic
GBBB	Stationary
GBBC	Nonstationary
GC	Information Processing
GCA	Digital
GD	Correlation
GDA	Auto-
GDB	Cross-
GE	One-Dimensional
GF	Two-Dimensional
GG	Linear
H	ACOUSTICS
HA	Attenuation
HAA	Absorption
HAB	Scatter
HABA	Backscatter Coefficient
HB	Modulation
HC	Refraction
HD	Reflectance
HE	Transmission
HF	Emission
HG	Artificial Sources
HH	Natural Sources
HI	Flux
HJ	Diffraction
HK	Frequency Spectrum
HL	Correlation

2
CUMULATIVE SUBJECT CROSS INDEX

3
OPTICAL SPECTRAL DATA

3.1. THEORY OF REFLECTANCE

The purpose of this discussion is to enable the user of this data compilation to consider the data in a proper perspective. The "reflectance" alone, for example, does not sufficiently describe the results of an experiment to allow the results to be used indiscriminately. One must have knowledge of the measuring instrument's characteristics, since they have measurable effect on interpretation of the output. Some important instrument parameters include spectral resolution, the solid angle of effective viewing, and characteristics of the radiation source.

Our present understanding of radiation theory does not permit an analytical description, in closed form, of the exact relationship between the radiation emitted by a source (whether natural or artificial) and the radiation received by a remote sensor after this radiation has been reflected by an object under surveillance. There are well known laws to describe the simple case of an electromagnetic wave incident upon a perfectly planar interface between two media. In this case, the reflected wave depends upon the radiation wavelength, the angle of incidence, and the physical properties (permittivity, permeability, and conductivity) of the two adjoining media. The laws governing such a case are sufficiently understood so that the refractive index and extinction coefficient of materials involved may be found by determining the reflection coefficients of the materials. For the more complicated case involving a surface with periodic or random surface irregularities, an analytic determination of the properties of the reflected electromagnetic field may only be approximated.

In the past ten years many papers have been published on scattering, or reflection from rough surfaces. Many theories have been developed, but none is both general and rigorous at the same time. To perform reasonably simple numerical calculations on the basis of these theories, certain simplifying assumptions are introduced, usually including one or more of the following:

(1) The dimensions of scattering elements of the rough surface are either much smaller or much greater than the wavelength of the incident radiation.
(2) The radii of curvature of the scattering elements are much greater than the wavelength of the incident radiation.
(3) Shadowing or obscuration effects occurring at the surface may be neglected.
(4) Only the far field is to be considered.
(5) Multiple reflections may be neglected.
(6) Consideration is restricted to a particular model of surface roughness (e.g., sawtooth, sinusoidal protrusions of definite shape and in random position, with random variations in height given by their statistical distribution and correlation function).

Electromagnetic scattering theory has been used in the past to compute radiation backscatter from targets in the microwave region of the spectrum, where the radiation wavelength is much greater than the minute irregularities of the target surface and where the conductivity of the target material is infinite. In the optical region, where materials have finite conductivity and the surface irregularities have a wide range in size relative to the radiation wavelength, present electromagnetic scattering theory is applicable to only a few special cases, so the only way to determine reflectance in this region for target and background objects is by experimentation.

One can arrive at the most general definition of reflectance ρ' (called bidirectional reflectance [3-1] by considering an infinitesimal element of surface, dA, upon which radiation of infinitesimal solid angle $d\omega_i$ and radiance L_i is incident. Taking a coordinate system fixed with respect to dA, with polar angle θ' measured from the normal and azimuth angle ϕ' measured from a fixed line (see fig. 3-1), the contribution to the reflected radiance, $dL_r(\theta'_r, \phi'_r)$, in the reflected pencil for the direction (θ'_r, ϕ'_r) is

$$dL_r(\theta'_r, \phi'_r) = \rho' L_i(\theta'_i, \phi'_i) \cos \theta'_i d\omega'_i \tag{3-1}$$

Generally, ρ' is a function of the incident and reflected directions (θ'_i, ϕ'_i and θ'_r, ϕ'_r respectively), the polarization (P), the wavelength (λ), and the optical parameters of the material on either side of the surface. Total radiance in a given reflected direction is obtained by integrating

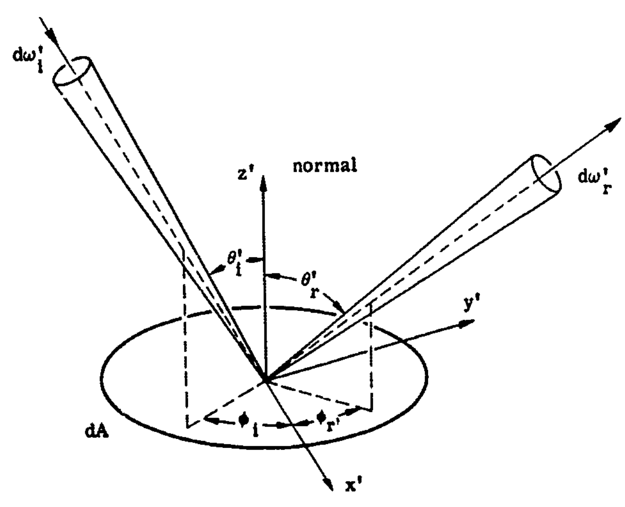


FIGURE 3-1. LOCAL COORDINATE SYSTEM FOR DETERMINING BIDIRECTIONAL REFLECTANCE

equation 1 over all incident directions, which yields

$$L_r(\theta_r', \phi_r') = \int \rho' L_i(\theta_i', \phi_i') \cos \theta_i' d\omega_i' \tag{3-2}$$

Also, by Helmholtz's reciprocity theorem, if the directions of the incident and reflected pencils are interchanged, the bidirectional reflectance is unchanged, i.e.,

$$\rho'(\theta_1', \phi_1'; \theta_2', \phi_2'; P; \lambda) = \rho'(\theta_2', \phi_2'; \theta_1', \phi_1'; P; \lambda) \tag{3-3}$$

Since the optical constants of materials may change from point to point, bidirectional reflectance becomes a function of the location of dA. If it is then assumed that the surface can be described by $z' = f(x', y')$, the correct functional dependence for reflectance is

$$\rho'(\theta_i', \phi_i'; \theta_r', \phi_r'; P; \lambda; x', y', z')_{z'=f(x',y')}$$

Generally, the direction of the normal to dA is also a function of the location of dA on the surface of the object. Hence, even if the incident and reflected radiation have a constant direction with respect to the (x', y', z') coordinates, the angles (θ_i', ϕ_i') and (θ_r', ϕ_r') (taken with respect to the local normal) would be a function of location of the surface element dA. For convenience, a second, absolute coordinate system is usually introduced, viz., (x, y, z). The x-y plane of this system is coincident with the average value of $z' = f(x', y')$ along the surface A, and is, therefore, the "average" plane of the reflector. The normal to this average plane is parallel to the z axis. Instead of referring the incident and reflected radiation to the local coordinates, they are then referred to the absolute system, with θ as the polar angle and ϕ as the azimuthal angle. The bidirectional reflectance with respect to this system is

$$\rho'(\theta_i, \phi_i; \theta_r, \phi_r; P; \lambda; x, y)$$

Another type of reflectance commonly considered is the directional reflectance ρ_d which is a function of only one direction, either the incident or reflected direction. In the case where reflected power is integrated over a hemisphere and incident power is from a specific direction, directional reflectance is denoted by ρ_{di}. The incident power $d\Phi_i$ is

$$d\Phi_i = dL_i(\theta_i, \phi_i) \cos \theta_i d\omega_i dA \tag{3-4}$$

and using equation 3-2,

$$dL_r = \rho' \frac{d\Phi_i}{dA} \tag{3-5}$$

Since the reflected power $d\Phi_r$ is given by

$$d\Phi_r = dA\int_{2\pi} dL_r \cos\theta_r \, d\omega_r = d\Phi_i\int_{2\pi} \rho' \cos\theta_r \, d\omega_r \tag{3-6}$$

therefore,

$$\rho_{di}(\theta_i, \phi_i; P; \lambda; x, y) = \int_{2\pi} \rho' \cos\theta_r \, d\omega_r \tag{3-7}$$

When dA is uniformly illuminated from all directions (L_i = constant), the corresponding directional reflectance, ρ_{dr}, is defined as the ratio of the radiance reflected in a given direction to the incident radiance. To proceed as previously,

$$L_r = \int_{2\pi} \rho' L_i \cos\theta_i \, d\omega_i = L_i\int_{2\pi} \rho' \cos\theta_i \, d\omega_i$$

and, thus,

$$\rho_{dr}(\theta_r, \phi_r; P; \lambda; x, y) = \int_{2\pi} \rho' \cos\theta_i \, d\omega_i \tag{3-8}$$

From comparison of equations 3-7 and 3-8,

$$\rho_{di}(\theta, \phi; P; \lambda; x, y) = \rho_{dr}(\theta, \phi; P; \lambda; x, y) = \rho_d \tag{3-9}$$

ρ_d is called directional reflectance.

3.2. INSTRUMENTATION

This section describes several types of instruments used to generate the optical data included in this compilation. An expression is derived for the "reflected quantity" measured by each type.

3.2.1. GENERAL ELECTRIC SPECTROPHOTOMETER [3-2]. A schematic diagram of this measurement apparatus is presented in figure 3-2. Monochromatic radiation from the source passes through a Nicol prism (N_1) and then through a Wollaston prism (W_1) oriented to N_1 at an azimuth angle α. The prism W_1 converts the radiation into two linearly polarized beams, the polarization of one of which is perpendicular to that of the other. The beams then pass through a rapidly rotating Nicol prism (N_2) and into the integrating sphere where, with the same angle of incidence, one impinges on a reference and the other on the sample materials. A detector looks into the sphere in a direction perpendicular to the plane of the two incident beams. The integrating sphere is coated with a diffuse reflector (MgO), the reflectance of which is assumed independent of polarization.

If f is used to denote the frequency of rotation of N_2 and t the time, the subscripts 1 and 2 to distinguish the beams incident on reference and sample respectively, the symbols $\perp$ and $\parallel$

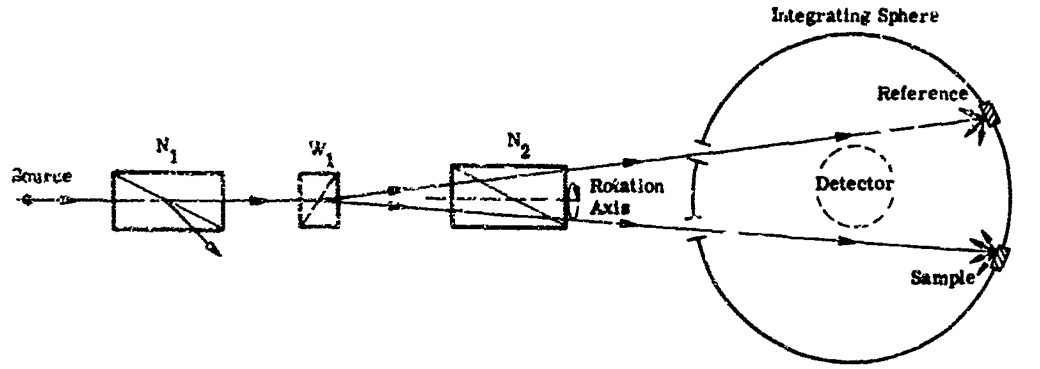


FIGURE 3-2. SCHEMATIC OF THE GENERAL ELECTRIC SPECTROPHOTOMETER

to represent the polarizations perpendicular to each other, and the superscripts i and r to represent incident and reflected radiation respectively, then the power at the detector (except for a factor dependent on the reflectance of the sphere) is

$$\Phi = \Phi_1^r + \Phi_2^r \tag{3-10}$$

The beams emerging from W_1 are linearly polarized and their powers given by

$$\begin{aligned} \Phi_1' &= \Phi_0 \sin^2 \alpha \\ \Phi_2' &= \Phi_0 \cos^2 \alpha \end{aligned} \tag{3-11}$$

where Φ_0 is the power from N_1. The prism N_2 passes that portion of the power polarized in a fixed direction, so that

$$\begin{aligned} \Phi_1^i &= \Phi_1' \sin^2 (2\pi ft) = \Phi_0 \sin^2 \alpha \sin^2 (2\pi ft) \\ \Phi_2^i &= \Phi_2' \cos^2 (2\pi ft) = \Phi_0 \cos^2 \alpha \cos^2 (2\pi ft) \end{aligned} \tag{3-12}$$

If it is assumed that the directional reflectance of the reference, $\rho_{d,1}(\lambda)$, is independent of polarization,

$$\Phi_1^r = \rho_{d,1}(\lambda)\Phi_1^i = \rho_{d,1}(\lambda)\Phi_0 \sin^2 \alpha \sin^2 (2\pi ft) \tag{3-13}$$

If the polarization symbols $||$ and $\perp$ are taken to refer to the polarization parallel to the directions in which beam 2 emerging from N_2 is maximum and minimum, respectively, then the power reflected from the sample is

$$\Phi_2^r = \Phi_0 \cos^2 \alpha \cos^2 (2\pi ft)\left[\rho_{d,2}(||, \lambda) \cos^2 (2\pi ft) + \rho_{d,2}(\perp, \lambda) \sin^2 (2\pi ft)\right] \tag{3-14}$$

The power at the detector is then*

$$\Phi = \Phi_0\left\{\rho_1 \sin^2 \alpha \sin^2 (2\pi ft) + \cos^2 \alpha \cos^2 (2\pi ft)\left[\rho_2(\|, \lambda) \cos^2 (2\pi ft) + \rho_2(\perp, \lambda) \sin^2 (2\pi ft)\right]\right\} \quad (3\text{-}15)$$

Rearranging terms gives

$$\begin{aligned} \Phi = {} & 1/2\left\{\rho_1(\lambda) \sin^2 \alpha + \cos^2 \alpha\left[\frac{3}{2}\rho^2 (\|, \lambda) + \frac{1}{2}\rho_2(\perp, \lambda)\right]\right\} \\ & - 1/2\left[\rho_1(\lambda) \sin^2 \alpha - \rho_2(\|, \lambda) \cos^2 \alpha\right] \cos (4\pi ft) \\ & + 1/8\left[\rho_2(\|, \lambda) - \rho_2(\perp, \lambda)\right] \cos (8\pi ft) \cos^2 \alpha \end{aligned} \quad (3\text{-}16)$$

The a-c portion of the output from the detector, having a frequency of 2f, is fed to a motor which rotates N_1 so that it takes that position for which

$$\rho_1(\lambda) \sin^2 \alpha = \rho_2(\|, \lambda) \cos^2 \alpha \quad (3\text{-}17)$$

A simple measurement of α allows $\rho_2(\|, \lambda)$ to be computed from

$$\rho_2(\|, \lambda) = \rho_1 \tan^2 \alpha \quad (3\text{-}18)$$

when the reflectance of the reference, $\rho_1(\lambda)$, is known. The directional reflectance ρ_2 is, of course, a function of the direction of incidence, and, therefore, the calculated value is correct only for that particular direction.

Since the incident beam is not infinitesimally narrow, it illuminates a finite, albeit small, area of the sample. Therefore, the computed directional reflectance of the sample is really the true reflectance averaged over the illuminated area,

$$\overline{\rho}_2(\|, \lambda) = \frac{1}{A} \int_A \rho_2(\|; \lambda; x, y)\, dx\, dy \quad (3\text{-}19)$$

where A is the illuminated area of the sample, and similarly for ρ_1. Hence, in terms of the reference $\overline{\rho}_1$, the reflectance of the sample is

$$\frac{\overline{\rho}_2(\|, \lambda)}{\overline{\rho}_1(\lambda)} = \tan^2 \alpha$$

3.2.2. BECKMAN DK-2 SPECTROPHOTOMETER WITH REFLECTANCE ATTACHMENT. Figure 3-3 is an illustration of this measuring device. Monochromatic light is reflected from an oscillating plane mirror (M_1) alternately to one of two spherical mirrors (M_2 and M_3). M_1 is

*The subscript d has been dropped.

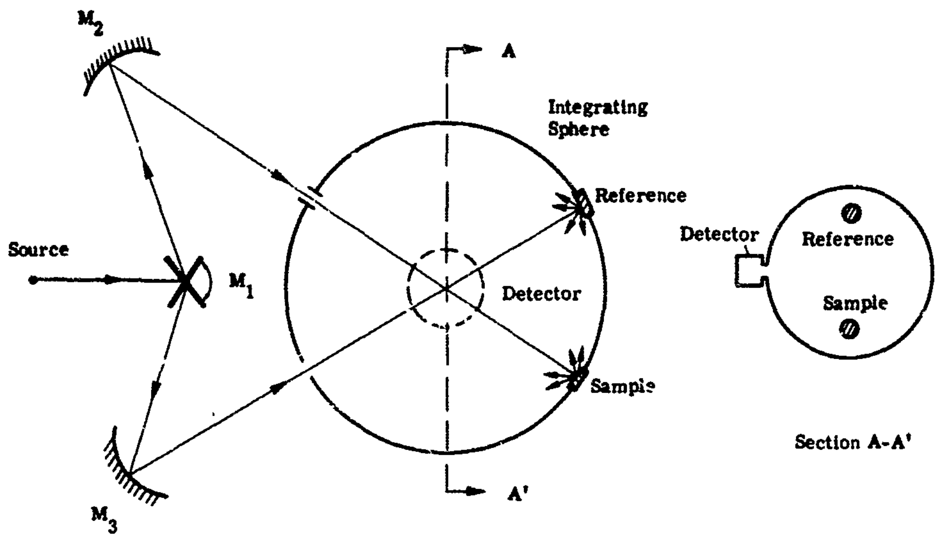


FIGURE 3-3. SCHEMATIC OF THE BECKMAN SPECTROPHOTOMETER WITH REFLECTANCE ATTACHMENT

positioned in the focal planes of M_2 and M_3. Thus, the radiation is reflected alternately, with little divergence, onto the reference and the sample at normal incidence. The detector compares the reflected power from the reference and sample and gives the ratio of the two.

Because the monochromator is a prism instrument, the radiation incident on M_1 is slightly polarized. More polarization results from reflection from the plane and spherical mirrors. Radiation entering the integrating sphere is probably elliptically polarized. If the subscripts 1 and 2 are used for quantities referring to the reference and sample respectively, and $\rho_d(P, \lambda, n)$ is taken to represent the directional reflectance at normal incidence, wavelength λ, and polarization P, the reflected powers are

$$\begin{aligned} \Phi_1^r &= \rho_{d,1}(\lambda, n)\Phi_0 \\ \Phi_2^r &= \rho_{d,2}(P, \lambda, n)\Phi_0 \end{aligned} \tag{3-20}$$

where Φ_0 is the incident power of wavelength λ and polarization P. It is assumed that the reflectance of the reference is not polarization dependent.

Because the radiation is incident normal to the reflectors, that portion of the power which is specularly reflected will exit through the entrance ports undetected. If $\rho_s(P, \lambda, n)$ is taken as the specular reflectance for normal incidence, wavelength λ, and polarization P, then the specularly reflected powers are $\rho_{s,1}(\lambda, n)\Phi_0$ and $\rho_{s,2}(P, \lambda, n)\Phi_0$ for the reference and sample respectively. If the incident radiation had no divergence and filled the whole entrance port,

none of the specularly reflected radiation would be detected. However, because of the divergence of the incident beam and the configuration of the equipment, only a fraction k of this radiation would be undetected. Therefore, the detected powers are

$$\begin{aligned}\Phi_1^r &= [\rho_{d,1}(\lambda, n) - k\rho_{s,1}(\lambda, n)]\Phi_0 \\ \Phi_2^r &= [\rho_{d,2}(P, \lambda, n) - k\rho_{s,2}(P, \lambda, n)]\Phi_0\end{aligned} \tag{3-21}$$

The same value of k is used for both reference and sample because of symmetry. The value reported by the detector represents the ratio

$$\frac{\rho_{d,2}(P, \lambda, n) - k\rho_{s,2}(P, \lambda, n)}{\rho_{d,1}(\lambda, n) - k\rho_{s,1}(\lambda, n)} = \frac{\Phi_1^r}{\Phi_2^r}$$

Again, the indicated reflectances are averages over the illuminated areas.

3.2.3. COBLENTZ HEMISPHERE USED BY NEW YORK UNIVERSITY. This measurement apparatus uses a hemispherical specular reflector (see fig. 3-4) with the sample and detector located a small distance from and diametrically opposite to the center of the sphere. Through an entrance port, well collimated, monochromatic radiation becomes incident on the sample at a fixed angle. Because of imaging problems associated with the off-center location of the sample, the aperture of the detector should be larger than the sample to guarantee that most of the radiation reflected from the hemisphere is detected. With $L_i(\lambda; P_i; \theta_i, \phi_i)$ representing the radiance with wavelength λ and polarization P_i incident on the sample in the direction (θ_i, ϕ_i), the radiance reflected by the sample, L_r, is

$$L_r(\lambda; P_r; \theta_r, \phi_r) = \rho'(\lambda; P_i; \theta_r, \phi_r; \theta_i, \phi_i)L_i \cos \theta_i d\omega_r \tag{3-22}$$

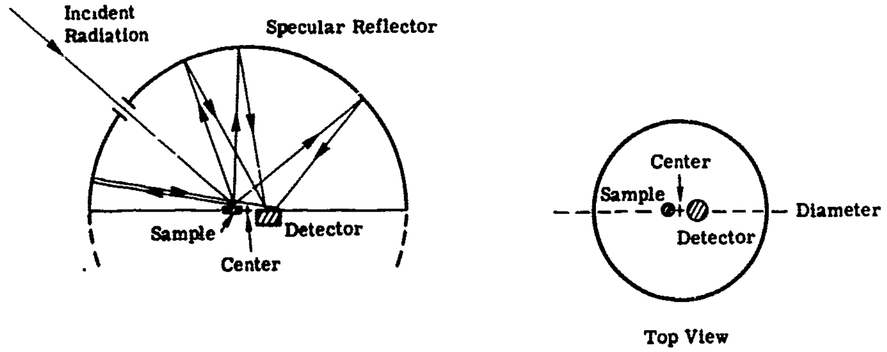


FIGURE 3-4. SCHEMATIC OF THE COBLENTZ HEMISPHERICAL REFLECTANCE ATTACHMENT USED BY NEW YORK UNIVERSITY

where the subscript r designates reflected radiation and ρ' is the bidirectional reflectance for incident polarization P_i. Given the directions of incidence and reflection, P_i, and λ, P_r may be determined.

If it can be assumed that the distance from the sample to the center of the sphere is very small compared to the radius of the sphere and that the area being illuminated is small, then the reflected radiance is approximately normally incident on the sphere. For normal incidence, the reflectance of the sphere, ρ_s, is independent of polarization of the incident radiation and depends only on its wavelength. The power Φ at the detector is, thus,

$$\Phi = \rho_s(\lambda) L_i \cos\theta_i \, d\omega_i A \int_{\omega_r = 2\pi} \rho'(\lambda; P_i; \theta_r, \phi_r; \theta_i, \phi_i) \cos\theta_r \, d\omega_r \tag{3-23}$$

where N_i is taken as uniform across the illuminated area A, ω_r as the solid angle for reflection from the sample, and ρ' as the bidirectional reflectance averaged over A. From the definition for ρ_d,

$$\Phi = L_i \cos\theta_i \, d\omega_i A \rho_s(\lambda) \rho_d(\lambda; P_i; \theta_i, \phi_i) \tag{3-24}$$

By making two measurements, one with the sample and one with a reference having a directional reflectance $\rho_{d,1}$ which is known,

$$\frac{\rho_d(\lambda; P_i; \theta_i, \phi_i)}{\rho_{d,1}(\lambda; P_i; \theta_i, \phi_i)} = \frac{\Phi}{\Phi_1} \tag{3-25}$$

is obtained, where the power reflected from the reference and the reflectances are averaged over the illuminated areas.

Equation 3-24 represents the power incident in the plane of the detector. In reality, however, the acceptance angle of the detector, ω_d, is less than 2π, so the power received by the detector, Φ_{rec}, is given by

$$\Phi_{rec} = (\omega_d/2\pi)\Phi$$

At angles of grazing incidence in the plane of the detector, radiation is reflected by the detector and is strongly polarized. This radiation is reflected off the hemisphere and onto the sample. Therefore, there will be some error caused by multiple reflections, and these reflections will be more strongly polarized than the initial radiation from the monochromator.

3.2.4. PORTABLE SPECTROPHOTOMETER USED BY USAERDL. This instrument is shown in figure 3-5. White, unpolarized radiation from the source is reflected from a plane mirror (M_1) onto the sample. Radiation reflected from the sample is focused onto the detector aperture by a spherical mirror (M_2). The detector is located in the focal plane of M_2 and thus

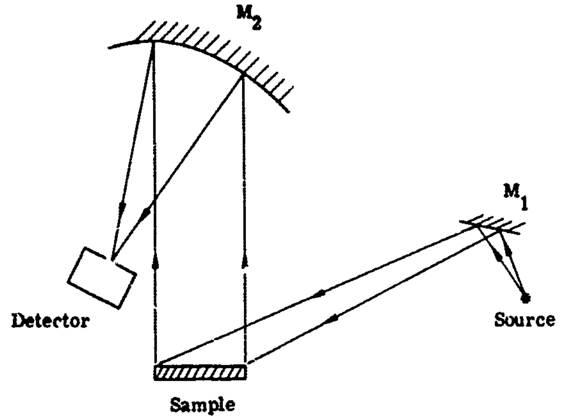


FIGURE 3-5. SCHEMATIC OF THE USAERDL PORTABLE SPECTROPHOTOMETER

receives only the radiation reflected normally from the sample. In practice, the detector is a monochromator, so only radiation at a particular wavelength λ is sensed. The source and M_1 can be moved about to give different angles of incidence on the sample. As a result of reflection from M_1 the radiance incident on the sample is probably partially polarized.

The spectral radiance incident on an area dA of the sample located at (x, y) is $L_i(\lambda; P; \theta_i, \phi_i; x, y)$, where P is the polarization for the incident direction (θ_i, ϕ_i). For this particular configuration, (θ_i, ϕ_i) is determined by (x, y). The spectral power reflected normally ($\theta_r = 0°$) by each dA is $d\Phi$:

$$d\Phi = dAL_i(\lambda, P)\left[\int_{\Delta\omega_i} \rho'(\lambda; P; \theta_i, \phi_i; n; x, y) \cos \theta_i \, d\omega_i\right] d\omega_r \tag{3-26}$$

where ρ' is the spectral bidirectional reflectance for radiation of polarization P which is incident from (θ_i, ϕ_i) on the area at (x, y) and reflected normally (indicated by the symbol n); $\Delta\omega_i$ is the solid angle of the source as seen from the sample, and it is assumed that L_i is constant* in each $\Delta\omega_i$. The total power Φ reflected normally by the sample (of area A) is

$$\Phi = L_i(\lambda, P)\left[\int_A \int_{\Delta\omega_i} \rho'(\lambda; P; \theta_i, \phi_i; n; x, y) \cos \theta_i \, d\omega_i \, dA\right] d\omega_r \tag{3-27}$$

*It has been assumed that $\Delta\omega_i$ is small enough so that a constant, meaningful polarization can be associated with the pencil of radiation.

For a reference with bidirectional reflectance ρ'_r that is independent of position and polarization, the detected power Φ is

$$\Phi' = L_i(\lambda, P)A\left[\int_{\Delta\omega_i} \rho'_r(\lambda;\ \theta_i, \phi_i;\ n) \cos\theta_i\, d\omega_i\right] d\omega_r \tag{3-28}$$

The ratio of the power detected from the sample to that from the reference is

$$\frac{\Phi}{\Phi'} = \frac{\int_{\Delta\omega_i} \bar{\rho}'(\lambda;\ P;\ \theta_i, \phi_i;\ n) \cos\theta_i\, d\omega_i}{\int_{\Delta\omega_i} \rho'_r(\lambda;\ \theta_i, \phi_i;\ n) \cos\theta_i\, d\omega_i} \tag{3-29}$$

where $\bar{\rho}$ is the average of ρ' over the area A, i.e.,

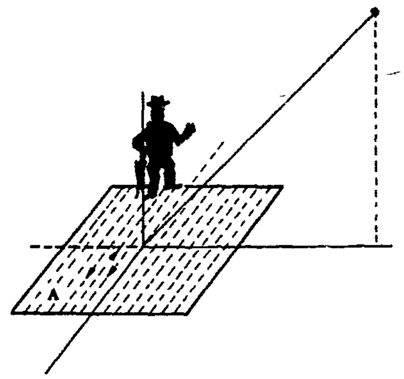
$$\bar{\rho}' = \frac{1}{A}\int_A \rho'\, dA \tag{3-30}$$

With $\Delta\omega_i$ so small that quantities may be considered constant throughout it, equation 3-29 becomes

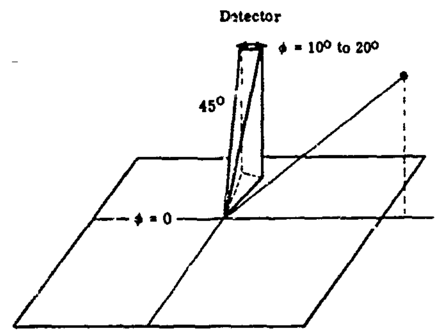
$$\frac{\bar{\rho}'(\lambda;\ P;\ \theta_i, \phi_i;\ n)}{\rho'_r(\lambda;\ \theta_i, \phi_i;\ n)} = \frac{\Phi}{\Phi'} \tag{3-31}$$

In practice, the beam incident on the sample in this case is divergent. Since reflectance for most objects exhibits angular dependence, and since a divergent beam represents a range of incidence angles, it intuitively appears that the divergence angle will affect the final reflectance value.

3.2.5. KRINOV'S FIELD MEASUREMENTS [3-3]. The methods described in this section were used for field measurements with the sun and a clear sky as the radiation source. The measurement procedure varied depending upon whether the surface measured was horizontal or vertical. For horizontal surfaces, the detector was oriented in one of two positions: looking directly downward or looking downward at 45° to the vertical. To establish a reference system for further discussion, all azimuth values are relative to the sun which is defined to be at an azimuth of 180°; angles are considered positive when measured clockwise from the zero-azimuth line. When looking downward, the detector was either moved back and forth along the 90°-270° line over a large area (cf. fig. 3-6a) or rotated 5° to 10° about a vertical axis coincident with its viewing direction (cf. fig. 3-6b). In the first case, when the detector was moved back and forth over a large area of the ground being observed, the instrument was always oriented normal to the ground. In effect, the measurement was bidirectional if it can be assumed that all the incident radiation emanates from the sun. Under this assumption, $\rho'(\theta_i, \phi_i;\ \theta_r, \phi_r) = \rho'(\theta_{sun}, 180;\ 0, 0)$. This measurement is integrated over the area of the ground observed. In the second case, the



(a) Horizontal surfaces: man walks over area A to be measured with the spectrograph; spectrograph is oriented normal to ground and looking downward for as much as 30 min.



(b) Horizontal surfaces: $\theta = 45^{\circ}$; $\phi = 270^{\circ}$; spectrograph rotated 10 to 20° in azimuth.

FIGURE 3-6. SCHEMATIC OF MEASUREMENT CONFIGURATION USED BY KRINOV

spectrograph was mounted on a tripod and directed at the sample at an angle of 45° from the normal and an azimuth of 270°. The spectrograph was then rotated on the tripod through an azimuth of 10° to 20°. When measuring vertical surfaces, i.e., trees, cliffs, or walls, the spectrograph was directed horizontally or slightly upward at the surface and at azimuths of 45° or 315°, and the instrument was then also rotated through a small azimuth.

Because the incident radiation comes from the sun and clear sky, the incident spectral radiance is very dependent on angle and not quite unpolarized (particularly in the blue region of the spectrum): $L_i(\lambda; P_i; \theta_i, \phi_i)$, with (θ_i, ϕ_i) the direction of incidence and P_i the polarization. Also, the time of day, season, and atmospheric condition act as variables. $d\Phi_s$ is the spectral power reflected by a surface element dA and into the rather large solid angle ω_D which subtends the detector:

$$d\Phi_s(\lambda) = dA \int_{\omega_D} d\omega_D \int_{\omega_i=2\pi} \rho'(\lambda; P_i; \theta_i, \phi_i; \theta_r, \phi_r) L_i(\lambda; P_i; \theta_i, \phi_i) \cos\theta_i \, d\omega_i \qquad (3\text{-}32)$$

where (θ_r, ϕ_r) is the direction of reflectance, ω_i the solid angle of incidence, and ρ' the bidirectional reflectance. The recorder for this system is photographic film, hence the system records energy. Assuming the detector views an area A at any time and scans at a constant rate over a time T, and that L_i is independent of time, then the spectral energy reflected by the sample, $Q_s(\lambda)$, is

$$Q_s(\lambda) = TA \int_{\omega_D} d\omega_D \int_{\omega_i=2\pi} \bar{\rho}'(\lambda; P_i; \theta_i, \phi_i; \theta_r, \phi_r) L_i(\lambda; P_i; \theta_i, \phi_i) \cos\theta_i \, d\omega_i \qquad (3\text{-}33)$$

where $\bar{\rho}'$ is ρ' averaged over the scanned area A_s, i.e.,

$$\bar{\rho}' = \frac{1}{A_s}\int_{A_s} \rho' \, dA$$

The sample can be replaced by a reference the reflectance of which, ρ_r' does not vary with position, and the film exposed for a time T without scanning. The reflected spectral energy $Q_R(\lambda)$ is then

$$Q_R(\lambda) = TA\int_{\omega_D} d\omega_D \int_{\omega_i=2\pi} \rho_r'(\lambda;\, P_i;\, \theta_i,\, \phi_i;\, \theta_r,\, \phi_r) L_i \cos\theta_i \, d\omega_i \tag{3-34}$$

A comparison of $Q_s(\lambda)$ and $Q_R(\lambda)$ may then be made.

For a second case referred to above, the results are the same if A_s is set equal to A, since it may be assumed that A is imaged onto a small area of the film and the average of $Q_s(\lambda)$ over this small area is taken. With the detector pointed downwards at 45° to the vertical and at an azimuth of 90° or 225° the results are obtained as shown with appropriate changes in θ_r and ϕ_r. Similar equations may be derived for vertical surfaces.

3.2.6. HOHLRAUM REFLECTANCE ATTACHMENT. This interesting apparatus for determining spectral reflectance is shown in figure 3-7. It consists of a blackbody cavity with a

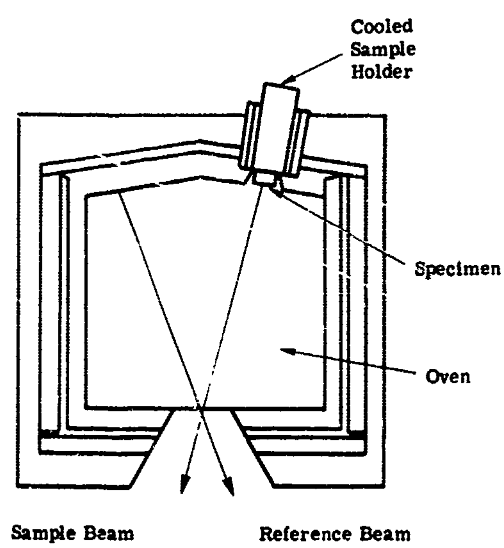


FIGURE 3-7. SCHEMATIC OF THE HOHLRAUM REFLECTANCE ATTACHMENT

viewing port. The viewing port is small enough so that the radiation in the cavity closely approximates the blackbody case, and the portions of the inner wall visible through the port occupy only a small solid angle. The sample is water cooled and is oriented with its normal at an angle of 13° to the viewing direction. If dA is again taken to represent the area of the sample viewed and ρ' to represent the bidirectional reflectance, the spectral power Φ_r reflected by the sample through the viewing port is

$$\Phi_r(\lambda) = dA L_r(\lambda) \cos(13^\circ) d\omega_r = d\Sigma d\omega_s L_r(\lambda) \tag{3-35}$$

where $L_r(\lambda)$ is the reflected spectral radiance, $d\omega_r$ the solid angle subtended by the viewing port at the sample, $d\Sigma$ the area of the detector (considered small), and $d\omega_s$ the solid angle subtended by the sample at the detector ($d\omega_s$ is considered normal to $d\Sigma$).

$$L_r(\lambda) = \int_{\omega_i} \rho'(\lambda; P_i; \theta_i, \phi_i; \theta_r, \phi_r) L_i(\lambda) \cos\theta_i d\omega_i \tag{3-36}$$

where $L_i(\lambda)$ is the incident spectral radiance, (θ_i, ϕ_i) the incident direction, ω_i the angle subtended at the sample by the entrance to the sample holder, and P_i the polarization of the incident radiation. The incident radiation is blackbody type and hence unpolarized; furthermore, the incident spectral radiance is a constant. Therefore,

$$\Phi_r(\lambda) = d\Sigma d\omega_s L_i(\lambda) \int_{\omega_i} \rho'(\lambda; P_i; \theta_i, \phi_i; 13^\circ, \phi_r) \cos\theta_i d\omega_i \tag{3-37}$$

Next, the detector is moved to view a flat area dA of the cavity wall far from the sample holder. The resulting spectral power, Φ_w, there is

$$\Phi_w(\lambda) = dA d\omega_w L_i(\lambda) \cos\theta_w = d\Sigma d\omega_s L_i(\lambda) \tag{3-38}$$

where θ_w is the angle between the viewing direction and the normal to the wall, and $d\omega_w$ is the solid angle subtended by the viewing port at the area dA on the wall. The ratio of the spectral powers detected is

$$\frac{\Phi_w(\lambda)}{\Phi_s(\lambda)} = \int_{\omega_i} \rho'(\lambda; P_i; \theta_i, \phi_i; 13^\circ, \phi_r) \cos\theta_i d\omega_i \tag{3-39}$$

Hence, the detector can be interpreted as giving the spectral bidirectional reflectance for unpolarized light, integrated over the projected solid angle of the source (as seen by the sample). Since it was assumed that the detector viewed only a very small area, dA, of the sample, the

bidirectional reflectance appearing under the integral applies only to that area. In some instances, the sample has been placed at the wall of the Hohlraum cavity instead of further into the sample holder. The ratio of powers detected is then

$$\frac{\Phi_w(\lambda)}{\Phi_s(\lambda)} = \int_{\omega_i=2\pi} \rho'(\lambda; P_i; \theta_i, \phi_i; 13^o, \phi_r) \cos \theta_i \, d\omega_i = \rho_d(\lambda; P_i; 13^o, \phi_r)$$

Once again, the reflectance measured is an average over the illuminated area.

3.2.7. DETROIT ARSENAL REFLECTANCE MEASUREMENTS [3-4]

The measurements reported herein from the Detroit Arsenal were made with a Perkin-Elmer Recording Spectrometer and a Coblentz hemispherical reflectance attachment. Figure 3-8 is a schematic diagram of the measurement apparatus. Basically, the incident radiation, which is very nearly monochromatic, is focused on the sample through a small hole in the hemisphere. The sample is located at a small distance from the sphere's center. Energy reflected by the sample in any direction is re-reflected by the gold-coated hemisphere (a specular reflector)

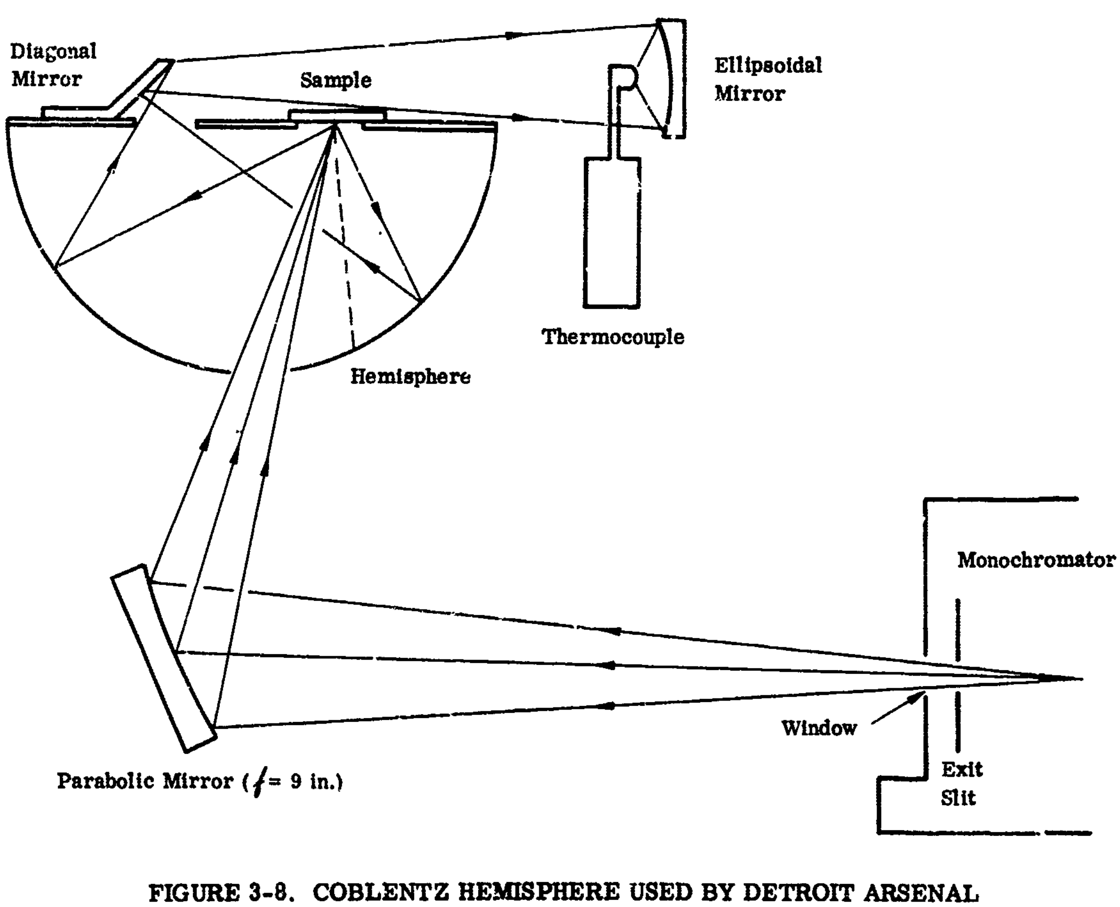


FIGURE 3-8. COBLENTZ HEMISPHERE USED BY DETROIT ARSENAL
Unclassified

and focused at a spot in the sample plane diametrically opposite the sample. By a system of mirrors the collected energy is focused on the detector.

The instrument was calibrated separately for specular reflectors and for diffuse reflectors. For specular reflectors, an evaporated aluminum standard of known reflectance was placed in the sample location, and the instrument slit widths were adjusted until the reading coincided with the predetermined value. The slit width was recorded for that wavelength and the procedure repeated at 1.0-μ intervals between 1 and 12 μ. The first wavelength read was 1 μ. The resulting set of slit widths was used for all samples considered specular, and the reading was recorded as reflectance. In the case of a diffuse reflector, the same procedure was followed using a smoked MgO standard.

3.2.8. NOTS POLARIZATION MEASUREMENTS [3-5]

The data obtained at the Naval Ordnance Test Station (NOTS), China Lake, Calif., consist of measurements of the degree of linear polarization of light reflected from target and background objects. The data result from a joint laboratory and field study and are reported in three forms:

(1) P_L vs. λ

(2) P_L vs. θ

(3) P_L vs. ϕ

where P_L = degree of linear polarization

λ = wavelength

θ = zenith angle of observation

ϕ = azimuth angle of observation

Field measurements were made using a specially designed polarimeter consisting of a Polaroid HN-22 high extinction linear polarization filter, an f/4 250-mm telephoto lens, an eyepiece to observe the field of view, and an RCA 200-4-25-2.0 silicon photodetector (fig. 3-9). The wavelength was monitored by inserting any one of a series of 20-mμ optical bandpass filters behind the polarization analyzer. The filters were centered at the following peak wavelengths: 486, 520, 546, 579, 589, 656, and 706 mμ. The detector field of view was 2°.

The polarimeter was mounted on a tripod for measuring terrain. The positions of the sun and polarimeter with respect to the observed ground were recorded using the notation shown in figure 3-3. The polarization analyzer was then rotated and currents corresponding to the maximum and minimum transmitted fluxes (I_1 and I_2) were recorded. The degree of linear polarization was calculated from the following equation:

$$P_L = \frac{I_1 - I_2}{I_1 + I_2}$$

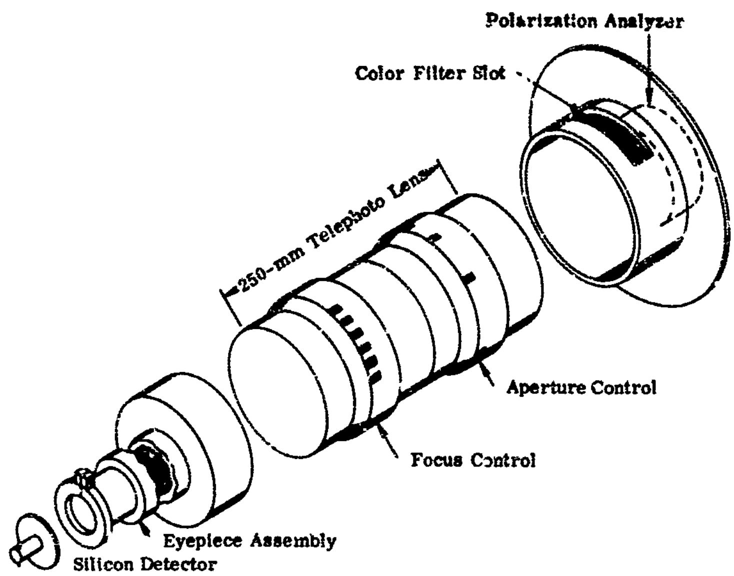


FIGURE 3-9. PHOTOELECTRIC FIELD POLARIMETER

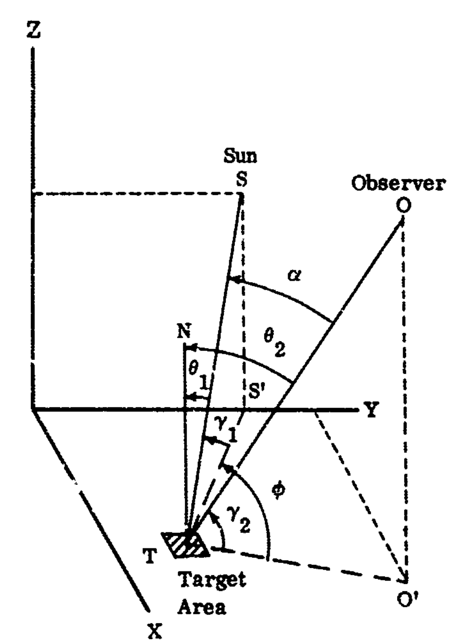


FIGURE 3-10. GEOMETRY OF FIELD MEASUREMENTS

Laboratory measurements were conducted in much the same way as the field studies. The instrument (fig. 3-11) differed basically from the field instrument in two respects: (1) an artificial source was used rather than the natural illumination, and (2) the source and the detector were coplanar; for the field measurements, the detector could be situated at any desired azimuth in relation to the sun. The source was fixed, while the sample could be tilted to allow various incidence angles. The detector could also be moved independent of the sample holder to permit several viewing angles.

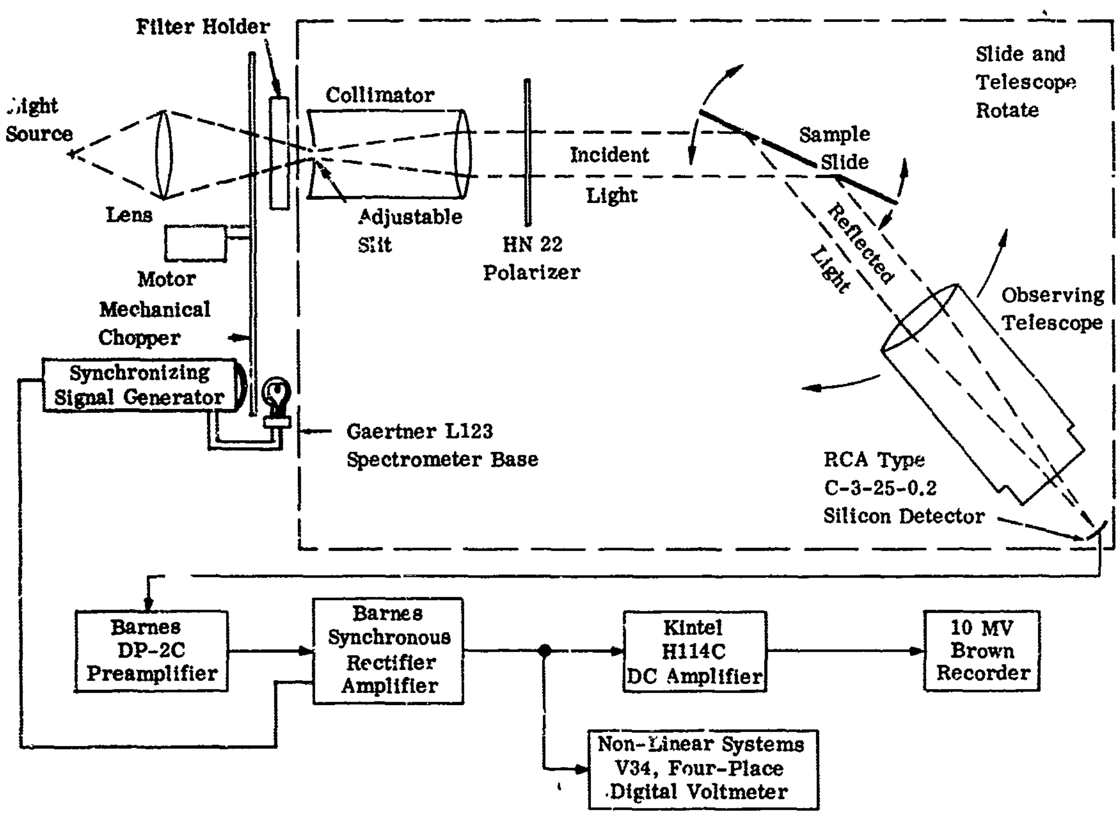


FIGURE 3-11. LABORATORY POLARIMETER AND INSTRUMENTATION

The illumination angles used in this study were 30°, 60°, and 80°, and the observation angle varied from 5° to 85°.

The polarizer was inserted in the incident beam in first the perpendicular and then the parallel orientation. Light reflected from the sample, $V_\perp$ and $V_{||}$ respectively, was recorded.

Here the degree of linear polarization, P_L, is given by

$$P_L = \frac{V_\perp - CV_{||}}{V_\perp + CV_{||}}$$

where $V_{\perp_{i,r}}$ = voltage observed upon reflection in the direction θ_r of perpendicularly polarized light at an incidence angle θ_i

$V_{\parallel_{i,r}}$ = voltage observed upon reflection in the direction θ_r of parallel polarized light at an incidence angle θ_i

3.2.9. CARY 14R REFLECTOMETER. This instrument is shown schematically in figure 3-12. Sample illumination was achieved by placing a high intensity source at a small port in the bottom of the integrating sphere. The sample is thus illuminated by a broad spectral band, hemispherical source. A double prism grating monochromator then alternately looks at a $MgCO_3$ reference and the sample. This instrument may be operated over the 0.2- to 2.2-μ range.

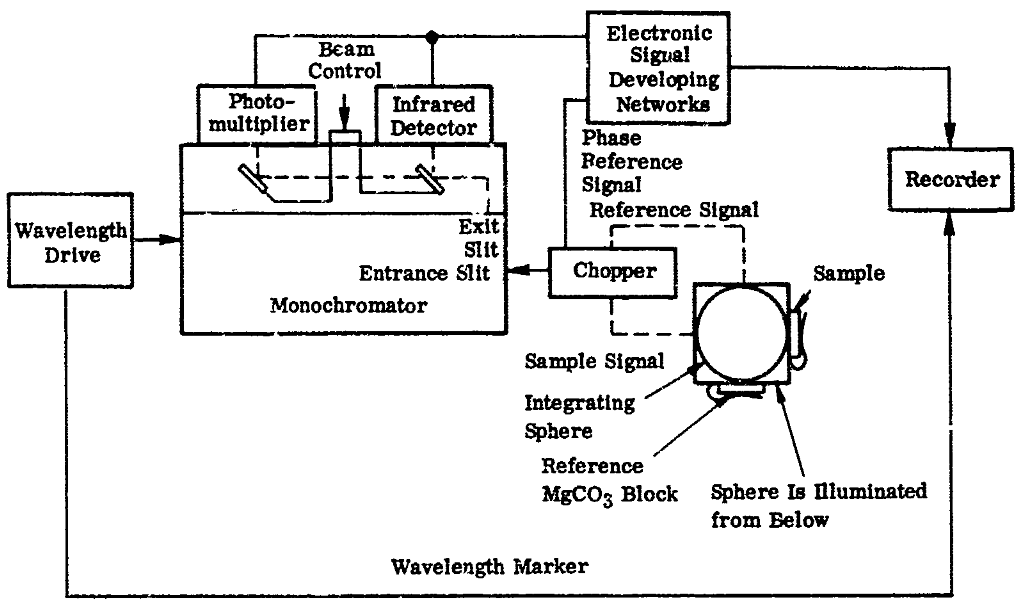


FIGURE 3-12. CARY 14R REFLECTOMETER [3-6]

3.2.10. PERKIN-ELMER NORMAL INCIDENCE REFLECTOMETER. This instrument is shown schematically in figure 3-13. In operation, broad spectral band light is collected and focused on the sample at the reflectance unit (fig. 3-14). Light reflected from the sample is collected and focused onto the entrance slit of a Perkin-Elmer Model 99 monochromator where it is analyzed spectrally from 0.2 to 0.4 μ. The measurements were made using a $MgCO_3$ reflectance standard.

3.3. ABSOLUTE REFLECTANCE

As is apparent from the earlier discussion, the measurement of reflectance is usually made relative to an arbitrary standard, and it is presented in that manner in many cases in this com-

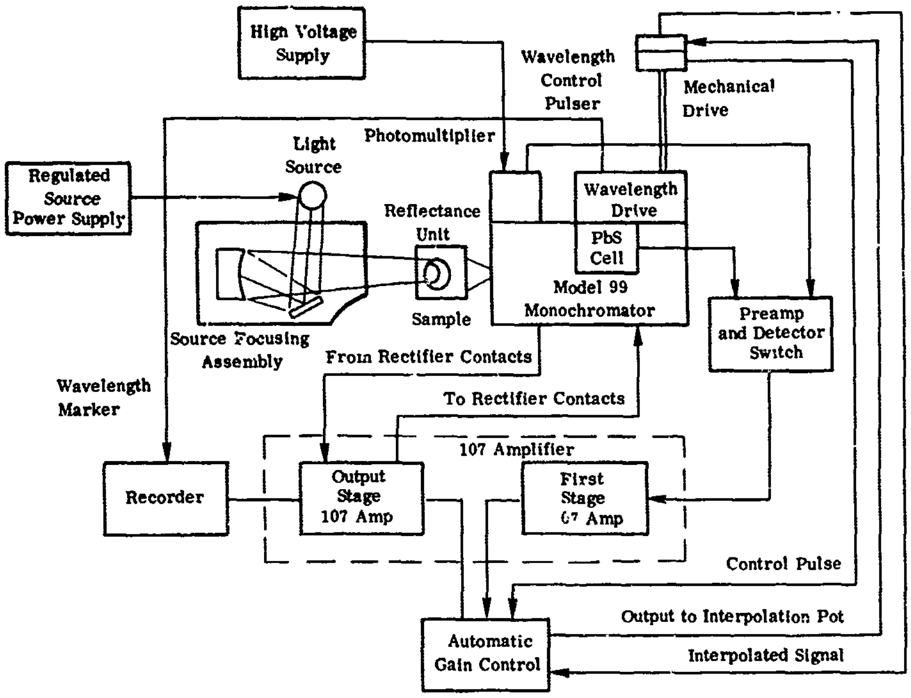


FIGURE 3-13. PERKIN-ELMER NORMAL INCIDENCE REFLECTOMETER [3-6]

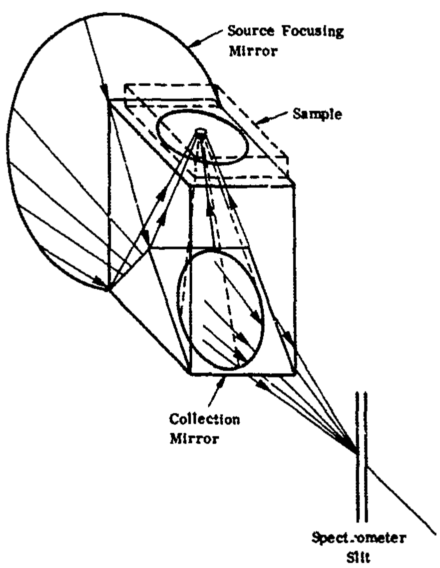


FIGURE 3-14. PERKIN-ELMER REFLECTANCE UNIT [3-6]

pilation. To convert such data to absolute values requires knowledge of the absolute reflectance of the standard used. An absolute measurement is of the following form:

$$\rho_d(\theta_i, \phi_i)_{abs} = \frac{p_{r,x}}{p_i} \tag{3-40}$$

where p_i is the power incident on the sample in the direction (θ_i, ϕ_i), and $p_{r,x}$ is the power reflected into a hemisphere by the sample. On the other hand, a relative measurement has the form

$$\rho_d(\theta_i, \phi_i)_{rel} = \frac{p_{r,x}}{p_{r,st}} \tag{3-41}$$

where, again, $p_{r,x}$ is the power reflected into a hemisphere by the sample, while $p_{r,st}$ is the power reflected into a hemisphere by some reflectance standard.

If the absolute directional reflectance of the standard, $\rho_{d,st}(\theta_i, \phi_i)_{abs}$ is known, the absolute reflectance of the sample can be calculated:

$$\rho_d(\theta_i, \phi_i)_{abs} = \frac{p_{r,st}}{p_i}$$

or

$$p_{r,st} = \rho_{d,st}(\theta_i, \phi_i)_{abs}\, p_i \tag{3-42}$$

Substituting equation 42 into equation 41 yields

$$\rho_d(\theta_i, \phi_i)_{rel} = \frac{p_{r,x}}{\rho_{d,st}(\theta_i, \phi_i)_{abs}\, p_i}$$

$$\rho_d(\theta_i, \phi_i)_{rel} = \frac{\rho_d(\theta_i, \phi_i)_{abs}}{\rho_{d,st}(\theta_i, \phi_i)_{abs}}$$

and, therefore,

$$\rho_d(\theta_i, \phi_i)_{abs} = \rho_d(\theta_i, \phi_i)_{rel}\, \rho_{d,st}(\theta_i, \phi_i)_{abs}$$

Thus, to obtain absolute values of the reflectance of a sample, it is necessary to multiply the relative reflectance of the sample by the absolute reflectance of the standard as measured at the same wavelength, incidence angle, etc.

To facilitate these computations, recommended values for the absolute reflectance of three commonly used reflectance standards, MgO, $BaSO_4$, and $MgCO_3$, are presented in figures 3-15 through 3-17. The reader is cautioned that although these curves are considered to represent the best data currently available, they are nevertheless subject to the errors inherent in the instrumentation used. If highly accurate results are necessary, the references cited should be consulted for a description of the measurement techniques and error analyses associated with the data. Section 3.4 indicates which of the optical data are reported as absolute and which as relative. For the relative data, the reflectance standard has also been designated.

It should also be noted that even after corrections for the standard are applied to data in this compilation, the curves may or may not more truly represent absolute reflectance. This is because the reflectance of such standards may vary within a few percent on the basis of preparation techniques, thickness and age of the samples, their exposure to ultraviolet radiation, etc. Since very few of the experiments considered have indicated in their reports the absolute reflectance of the standard used or completely described its preparation, it is impossible to say that the absolute reflectance shown in figures 3-15 through 3-17 is identical to that of the standard used in a given experiment.

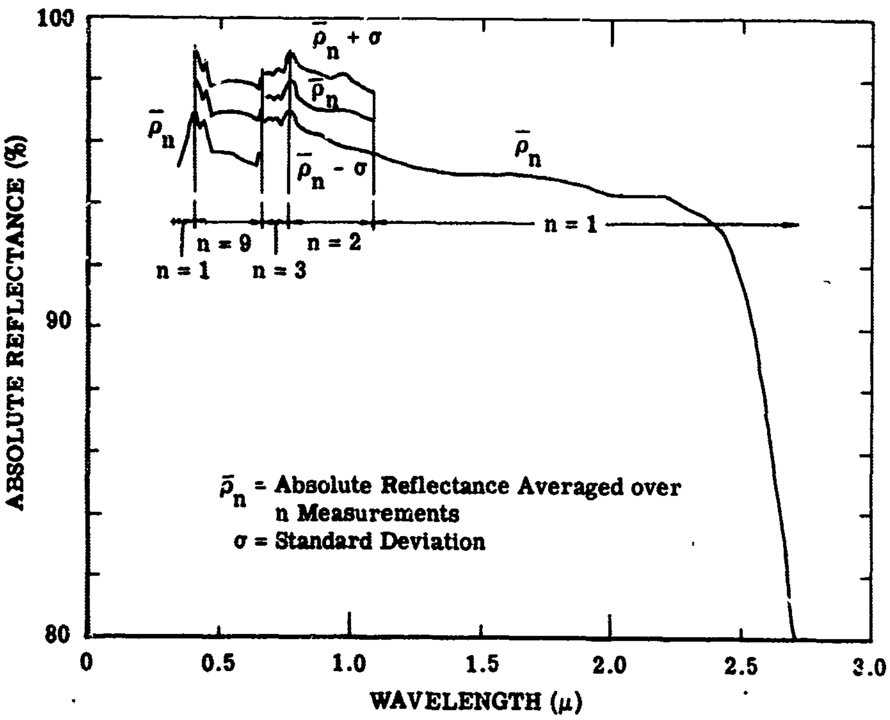


FIGURE 3-15. ABSOLUTE REFLECTANCE OF SMOKED MgO [3-7, 3-8, 3-9]

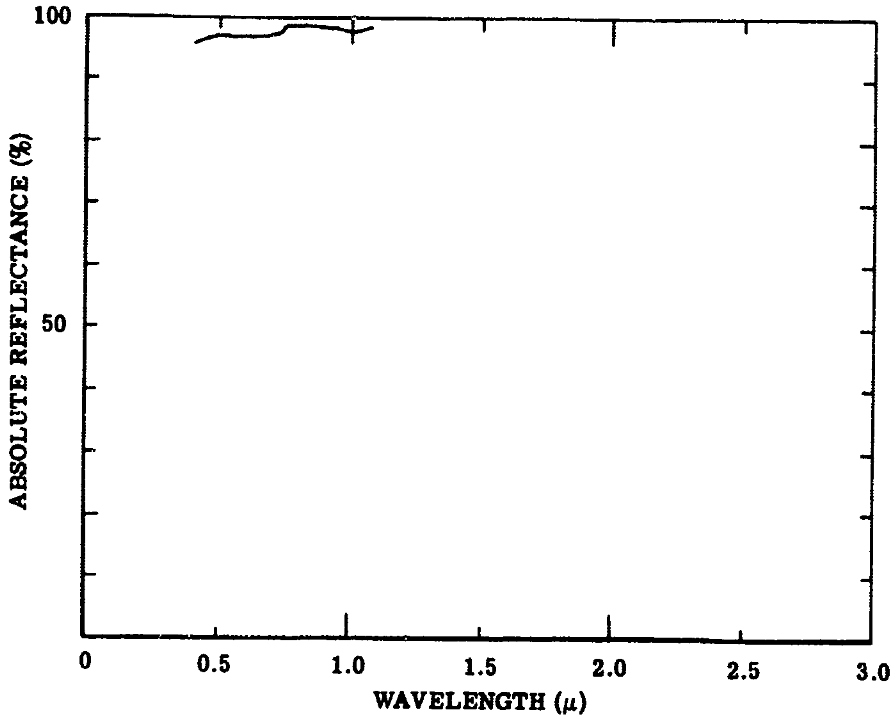


FIGURE 3-16. ABSOLUTE REFLEC 'ICE OF PRESSED $BaSO_4$ [3-8]

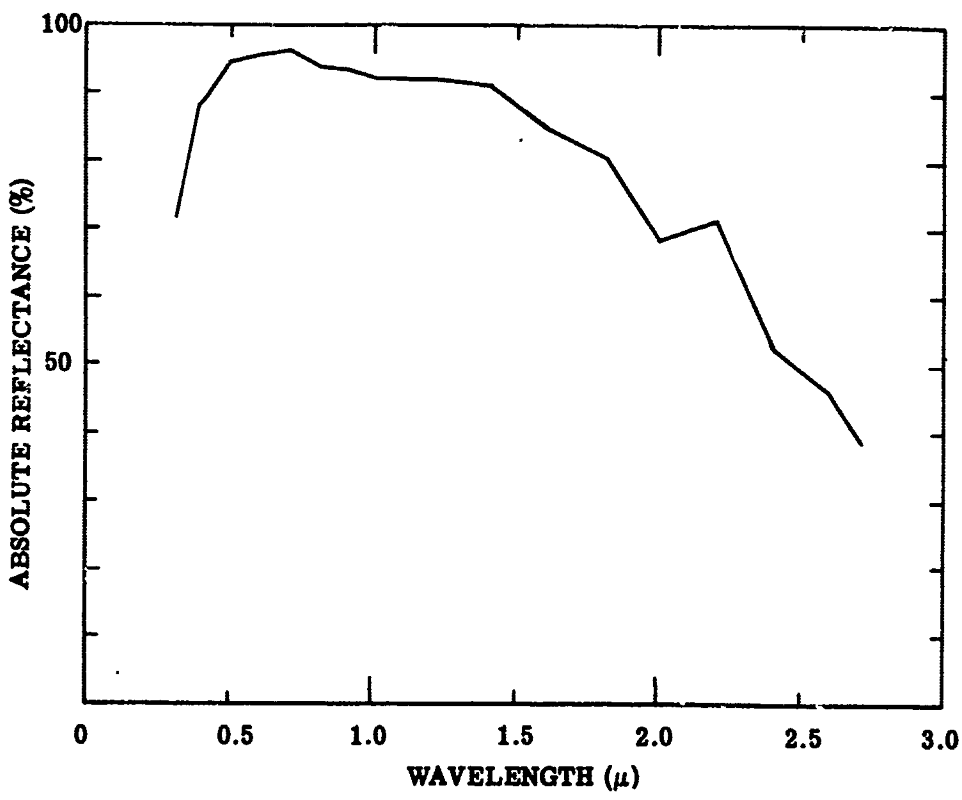


FIGURE 3-17. ABSOLUTE REFLECTANCE OF PRESSED $MgCO_3$ [3-7]

3.4. SUMMARY OF EXPERIMENTS YIELDING OPTICAL DATA

The documents from which the unclassified optical data have been extracted are briefly summarized on the following pages. These summaries are included to facilitate use of the data presented in section 3.7. Information on the experimental platform, instrumentation, reflectance standards (for relative data) and other related matters has been included, and additional references describing some of the instrumentation in greater detail are cited. As already indicated, the code consisting of the letter B and five digits at the beginning of each entry is the accessions number assigned to the document by the Target Signature Analysis Center. All curves extracted from the document carry this accessions number plus a number from 001 to 999, which is an arbitrary designation assigned to specific curves. The two numbers together constitute a curve's identification number. Bibliographical information on each of the documents is stated; the user is referred to the original source if more detailed information is required.

B-00829. Hopkins: Reflectance Curves of Various Leaves, unpub., USAERDL, Ft. Belvoir, Va., 1955 (est.).

Platform: laboratory

Instrument: USAERDL spectrophotometer (original design)
Quantity measured: ρ_d
Wavelength range: 0.9 to 2.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Comments: This instrument is no longer in operation. Basically, it consisted of a Ga... monochromator coupled with an integrating sphere.

B-00830. Hopkins: Reflectance Curves of Various Soils, unpub., USAERDL, Ft. Belvoir, Va., 1955 (est.).

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.2 μ
Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample
Reflectance standard: MgO
Additional reference: 3-10

Instrument 2: USAERDL spectrophotometer (original design)
Quantity measured: ρ_d
Wavelength range: 0.9 to 2.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Comments: This instrument is no longer in operation. Basically, it consisted of a Gaertner monochromator coupled with an integrating sphere.

B-01035. Sigler: Airborne Rapid Scan Spectrometer and Earth Reflectance Measurements as a Function of Altitude (Final Report), Inst. Div., Radiation, Inc., Orlando, Fla., July 195?.

Platform: airborne

Instrument: Perkin-Elmer 108 rapid-scan spectrometer
Quantity measured: α (albedo)
Wavelength range: 0.4 to 3.0 μ
Reflectance standard: data are absolute
Comments: These data were obtained by rotating a periscope (installed through a hole in the side of the aircraft) 180° to alternately view the sky radiation and that reflected by the earth.

B-01049. Billings: Reflection of Visible and Infrared Radiation from Leaves of Different Ecological Groups, Am. J. Bot., Vol. 38, 1951.

Platform: laboratory

Instrument: Beckman DU spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.1 μ
Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample
Reflectance standard: $MgCO_3$
Additional reference: 3-10

B-01175. Derksen, Monahan: A Reflectometer for Measuring Diffuse Reflectance in the Visible and Infrared Regions, J. Opt. Soc. Am., Vol. 42, No. 4, 1952.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references. 3-2, 3-11, 3-12
Comments: See section 3.2.1.

Instrument 2: Perkin-Elmer 12-B spectrometer
Quantity measured: ρ_d
Wavelength range: 1.0 to 2.7 μ
Reflectance attachment: Coblentz hemisphere
Reflectance standard: MgO
Additional references: 3-13, 3-14
Comments: See section 3.2.3.

B-01176. Wright: Spectral Reflectance Characteristics of Camouflage Greens Versus Camouflage Detection, IRMA III Report No. 1281, USAERDL, Ft. Belvoir, Va., March 1953.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-01337. Dvornik, Orr, Young: Reflectance Curves of Soil, Rocks, Vegetation, and Pavement, Report No. 1746R, USAERDL, Ft. Belvoir, Va., April 1963.

Platform: ground-based field

Instrument: USAERDL portable spectrophotometer
Quantity measured: ρ'
Wavelength range: 0.25 to 2.5 μ
Reflectance attachment: collecting mirror
Reflectance standard: measured relative to thermoglass and values converted to MgO
Additional reference: 3-15
Comments: See section 3.2.4.

B-01339. Haas et al.: Spectrophotometric and Colorimetric Study of Color Transparencies of Some Natural Objects, Report No. 4794, NBS, Washington, D. C., March 1957.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-01352. Haas, et al.: Spectrophotometric and Colorimetric Study of Diseased and Rust Resisting Cereal Crops, Report No. 4591, NBS, Washington, D. C., July 1956.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-01353. Hall, Keegan, Schleter: Spectrophotometric and Colorimetric Change in the Leaf of a White Oak Tree under Conditions of Natural Drying and Excessive Moisture, Report No. 4322, NBS, Washington, D. C., September 1955.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-01367. Haas et al.: Spectrophotometric and Colorimetric Study of Foliage Stored in Covered Metal Containers, Report No. 4370, NBS, Washington, D. C., November 1955.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-01368. Haas et al.: Spectrophotometric and Colorimetric Record of Some Leaves of Trees, Vegetation and Soils, Report No. 4528, NBS, Washington, D. C., April 1956.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-01370. Duntley: Reflectance of Natural Terrains, Report No. OSRD 6554, Louis Comfort Tiffany Foundation, Oyster Bay, N. Y., September 1945.

Platform: airborne

Instrument: Eastman Kodak spectrogeograph
Quantity measured: α (albedo)
Wavelength range: 0.43 to 0.73 μ
Reflectance standard: data are absolute
Comments: The data were obtained by rotating a periscope (installed through a hole in the side of the aircraft) 180° to alternately view the sky radiation and that reflected by the earth. The spectrophotometric curves obtained were derived from densitometer readings of spectrograms.

B-01643. Reflectance Data on Crops (unpub.), Mine Detection Branch, USAERDL, Ft. Belvoir, Va., 1962 (est.).

Platform: ground-based field

Instrument: USAERDL portable spectrophotometer
Quantity measured: ρ'
Wavelength range: 0.25 to 2.5 μ
Reflectance attachment: collecting mirror
Reflectance standard: measured relative to thermoglass and values converted to MgO
Additional reference: 3-15
Comments: See section 3.2.4.

B-01761. Shull: A Spectrophotometric Study of Reflection of Light from Leaf Surfaces, Botan. Gaz., Vol. 87, 1929.

Platform: laboratory

Instrument: spectrophotometer (original design)
Quantity measured: ρ_d
Wavelength range: 0.43 to 0.70 μ
Reflectance attachment: integrating sphere
Reflectance standard: $MgCO_3$

B-01813. Kronstein: Research, Studies, and Investigations on Spectral Reflectances and Absorption Characteristics of Camouflage Paint Materials and Natural Objects, Final Report, Contract DA-44-009 ENG-1447, New York Univ., New York, March 1955.

Platform: laboratory

Instrument 1: Beckman DK-2 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 2.5 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Comments: See section 3.2.2.

Instrument 2: Perkin-Elmer Model 12 and Model 112 spectrophotometers
Quantity measured: ρ_d
Wavelength range: 2.5 to 15 μ
Reflectance attachment: Coblentz hemisphere
Reflectance standard: Specular samples were measured relative to a rhodium mirror and diffuse samples relative to flowers of sulphur. Data have been converted to absolute values.
Comments: See section 3.2.3.

B-01948. Dinger: The Absorption of Radiant Energy in Plants, Ph.D thesis, Iowa State Univ., Iowa City, 1941.

Platform: laboratory

Instrument: photometric goniometer (original design)
Quantity measured: ρ', τ' (bidirectional transmittance)
Wavelength range: 0.35 to 0.75 μ
Reflectance standard: bond paper
Comments: Reflectance data were obtained by focusing monochromatic light on the sample at normal incidence, then examining the reflected component at 10° off normal. Bond paper, believed by the experimenter to have scattering properties similar to those of foliage, was measured in the same way, and the ratio of the two quantities is the reported reflectance. Transmittance measurements relative to bond paper were also made.

B-02250. Haas et al.: Spectrophotometric and Colorimetric Study of Color Transparencies of Some Man-Made Objects, Report No. 4953, NBS, Washington, D. C., November 1957.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also.

B-02418. Spectral Reflectance of Several Crops (unpub.), Purdue Univ., Lafayette, Ind., 1964.

Platform: laboratory

Instrument: Beckman DK-2 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.28 to 2.6 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Comments: See section 3.2.2.

B-03070. Gates et al.: Spectral Properties of Plants, Appl. Opt., Vol. 4, No. 1, 1965.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1. For transmittance measurements, the sample was placed at one of the entrance ports of the sphere, and MgO covered both the sample and reference ports.

Instrument 2: Cary 14 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.385 to 2.2 μ
Reflectance attachment: integrating sphere (Cary 1411)
Reflectance standard: MgO
Additional reference: 3-16
Comments: Operation is similar to that of the integrating sphere discussed in section 3.2.2. However, in this experiment the sample was illuminated with white light, and the radiation was spectrally dispersed <u>after</u> reflection. Also, the sample was viewed at 60° off normal.

B-03117. Turner: Reflectance Properties of Thin Films and Multilayers, Presented at Conf. on Radiative Transfer from Solid Materials, Boston, Mass., December 1960.

No descriptive information on these data was available.

B-03231. Dunkle, Gier: Spectral Reflectivity of Certain Minerals and Similar Inorganic Materials, Inst. Eng. Res., Univ. of Calif., Berkeley, January 1954, AD 26 394.

Platform: laboratory

Instrument: Perkin-Elmer spectrophotometer
Quantity measured: ρ_d
Wavelength range: 1.0 to 15.0 μ
Reflectance attachment: Hohlraum
Reflectance standard: data are absolute
Comments: See section 3.2.6.

B-03256. Clark, Hardy, Vinegar: Goniometric Spectrometer for the Measurement of Diffuse Reflectance and Transmittance of Skin in the Infrared Region, J. Opt. Soc. Am., Vol. 43, No. 11, 1953.

Platform: laboratory

Instrument: goniometer coupled with a Wadsworth-Littrow spectrometer
Quantity measured: ρ_d
Wavelength range: 0.55 to 2.5 μ
Reflectance attachment: see comments below
Reflectance standard: data are absolute
Comments: Measurement of diffuse reflectance was obtained by illuminating the sample with monochromatic light and automatically scanning the detector about the sample. The detector thus recorded the reflectance integrated over 180°. This process was repeated at several discrete wavelengths.

B-03258. Ashburn, Wilson: Spectral Diffuse Reflectance of Desert Surfaces, J. Opt. Soc. Am., Vol. 46, No. 8, 1956.

Platform: ground-based field and airborne

Instrument: albedometer (original design)
Quantity measured: α (albedo)
Wavelengtn range: 0.4 to 0.65 μ
Reflectance attachment: integrating sphere
Reflectance standard: unspecified, if any
Additional reference: 3-17
Comments: No information on whether the data are absolute or relative was available.

B-03303. Jacquez, Kuppenheim: Spectral Reflectance of Human Skin in the Region 235-1000 Millimicrons, J. Appl. Physiol., Vol. 7, March 1955.

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.235 to 0.70 μ
Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample
Reflectance standard: MgO
Additional reference: 3-10

Instrument 2: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-03304. Dimmitroff et al.: Spectral Reflectance of Human Skin in the Region 0.7-2.6 Microns, J. Appl. Physiol., Vol. 8, November 1955.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 0.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1

Instrument 2: Perkin-Elmer infrared spectrometer
Quantity measured: ρ_d
Wavelength range: 0.7 to 2.6 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-13, 3-18
Comments: This instrument is similar in operation to the Beckman DK-2 spectrophotometer discussed in section 3.2.2.

B-03305. Heer, Kuppenheim: Spectral Reflectance of White and Negro Skin between 440 and 1000 Millimicrons, J. Appl. Physiol., Vol. 4, April 1952.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.431 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-03333. Infrared Optical Measurements, Report No. 8626, NBS, Washington, D. C., December 1964.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

Instrument 2: Cary 14 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.26 to 2.2 μ
Reflectance attachment: integrating sphere (Cary 1411)
Reflectance standard: MgO
Additional reference: 3-16
Comments: Operation is similar to that of the integrating sphere discussed in section 3.2.2. However, in this experiment the sample was illuminated with white light, and the radiation was spectrally dispersed after reflection. Also, the sample was viewed at 60° off normal.

Instrument 3: Cary 90 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 2.5 to 15 μ
Reflectance attachment: white hemisphere
Reflectance standard: data are absolute
Additional reference: 3-19
Comments: The White attachment is basically a Coblentz-type hemisphere (see sec. 3.2.3). The sample was hemispherically illuminated with white light, and the reflected radiation was viewed slightly off normal.

B-03355. Miscellaneous data from several sources including N. Y. Univ., Syracuse Univ., and Detroit Arsenal, Warren, Mich. (unpub.), 1950 (est.).

Platform: laboratory

Instrument: see comments below
Quantity measured: ρ_d, τ
Wavelength range: 0.4 to 15.0 μ
Reflectance attachment: see comments below
Reflectance standard: see comments below
Comments: Several unpublished, miscellaneous curves from various sources are collected here. Curves B-03355-001 through B-03355-006 are transmission data on optical materials, and no descriptive information on the instrumentation for them was available. Curves B-03355-007 through B-03355-009 are the reflectance of water from 1 to 15 μ, for angles of incidence of 0^o, 60^o, and 80^o. Again, no descriptive information on this experiment was available. Curves B-03355-010 through B-03355-037 are reflectance data on foliage species for the visible and near-infrared regions and appear to be standard spectrophotometric curves (ρ_d). Curves B-03355-039 through B-03355-046 are the reflectance (ρ_d) of paints in the 0.4 to 2.6-μ interval and are believed to have been obtained, relative to MgO, on the Beckman DK-2 spectrophotometer (see sec. 3.2.2). Curves B-03355-047 through B-03355-053 were obtained on the Bausch and Lomb spectrophotometer (see under B-04642).

B-03374. Olson et al.: An Analysis of Measurements of Light Reflectance from Tree Foliage Made during 1960 and 1961, Report on Contract NR-387-025, Agricultural Expt. Sta., University of Illinois, Urbana, June 1964, AD 608-114.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 0.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-03463. Specular Spectral Reflectance of Paints from 0.4 to 40.0 Microns, Report No. 31, U. S. Dept. of Commerce, Washington, D. C., April 1964.

Platform: laboratory

Instrument 1: Cary 14 spectrophotometer
Quantity measured: ρ'
Wavelength range: 0.4 to 2.5 μ
Reflectance attachment: Cary Model 1413 specular-reflectance attachment
Reflectance standard: aluminum mirror
Comments: Angle of incidence was 8^o off normal.

Instrument 2: Beckman IR-7 spectrophotometer
Quantity measured: ρ'
Wavelength range: 2.5 to 15 μ
Reflectance attachment: Cary Model 24425 specular-reflectance attachment
Reflectance standard: aluminum mirror
Comments: Angle of incidence was 30^o off normal.

B-03559. Barbrow: Calibration on the Spectral Directional Reflectance of Six Samples of Red Pine Needles (unpub.), NBS, Test No. G-35201-1, Agr. Res. Serv., Beltsville, Md., November 1964.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

Instrument 2: Cary 14 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.26 to 2.2 μ
Reflectance attachment: integrating sphere (Cary 1411)
Reflectance standard: MgO
Additional reference: 3-16
Comments: Operation is similar to that of the integrating sphere discussed in section 3.2.2. However, in this experiment, the sample was illuminated with white light, and the radiation was spectrally dispersed after reflection. Also, the sample was viewed at 60° off normal.

Instrument 3: Cary 90 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 2.5 to 15 μ
Reflectance attachment: White hemisphere
Reflectance standard: data are absolute
Additional reference: 3-19
Comments: The White attachment is basically a Coblentz-type hemisphere (see sec. 3.2.3). The sample was hemispherically illuminated with white light, and the reflected radiation was viewed slightly off normal.

B-03804. Morris, Olson: Determination of Emissivity and Reflectivity Data on Aircraft Structural Materials, Part II, Supplement I, Report No. 56-222, Armour Res. Foundation, Chicago, Ill., October 1958, AD 202 494.

Platform: laboratory

Instrument 1: original design using a Perkin-Elmer monochromator
Quantity measured: ρ_d
Wavelength range: 0.3 to 0.4 μ and 0.7 to 2.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Comments: The instrument is similar in operation to the Beckman DK-2 spectrophotometer discussed in section 3.2.3, except that it is operated in the single-beam mode. Ratio recording is achieved by the substitution method.

Instrument 2: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 0.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-03856. Betz et al.: Techniques for Measurements of Total Normal Emissivity, Solar Absorptivity and Presentation of Results, Armour Res. Foundation, Chicago, Ill., October 1958.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 0.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

Instrument 2: Original design using a Perkin-Elmer monochromator
Quantity measured: ρ_d
Wavelength range: 0.3 to 0.4 μ and 0.7 to 2.7 μ
Reflectance attachment. integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Comments: This instrument is similar to the integrating sphere device described in section 3.2.[illegible] The sample and reference are alternately illuminated with monochromatic energy [illegible] 9° off normal.

B-03959. Edwards, Hall: Far Infrared Reflectance of Spacecraft Coatings, presented at the AIAA Thermophysics Specialist Conference, Monterey, Calif., September 1965.

Platform: laboratory

Instrument 1: Perkin-Elmer 98 monochromator coupled with an integrating sphere (original design)
Quantity measured: ρ_d
Wavelength range: 0.33 to 2.5 μ
Reflectance attachment: integrating sphere
Reflectance standard: data are absolute
Additional reference: 3-20
Comments: This instrument operates in the single-beam mode.

Instrument 2: Perkin-Elmer 98 monochromator with Hohlraum attachment
Quantity measured: ρ_d
Wavelength range: 1.5 to 15 μ
Reflectance attachment: Hohlraum
Reflectance standard: data are absolute
Additional references: 3-21 through 3-25
Comments: See section 3.2.6.

B-03960. Albright et al.: Solar Absorptance and Thermal Emittance of Aluminum Coated with Surface Films of Evaporated Aluminum Oxide, presented at the AIAA Thermophysics Specialist Conference, Monterey, Calif., September 1965.

Platform: laboratory

Instrument: Perkin-Elmer Model 13 and Model 20 spectrophotometers
Quantity measured: ρ'
Wavelength range: 5 to 15 μ
Reflectance attachment: specular-reflectance attachment
Reflectance standard: not specified

B-03995. Krinov: Spectral Reflectance Properties of Natural Formations (trans. by Belkov), Technical Translation No. 439, Nat. Res. Council of Canada, Ottawa, 1953.

Platform: Ground-based field and airborne

Instrument: several spectrographs
Quantity measured: ρ'
Wavelength range: 0.4 to 0.9 μ
Reflectance attachment: none
Reflectance standard: barite paper, gypsum
Comments: See section 3.2.5.

B-04424. Hall: Measurement on the Optical Properties of Snow, unpub., Willow Run Laboratories of the Institute of Science and Technology, The University of Michigan, Ann Arbor, 1965 (est.).

Platform: laboratory

Instrument: interferometric device
Quantity measured: ρ'
Wavelength range: 0.95 to 2.7 μ
Reflectance standard: flowers of sulphur

B-04616. Myers, Thomas: Reflectance of Cotton Leaves Under Various Conditions of Drying (unpub. data), U. S. Dept. of Agr., Agr. Res. Serv., Weslaco, Texas, June 1966.

Platform: laboratory

Instrument: Beckman DK-2 spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.5 to 2.5 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO for ρ_d, but values of τ_d are absolute
Comments: For transmittance measurements, the sample was positioned at one of the entrance ports of the integrating sphere, and MgO was placed at both the sample and reference ports (cf. fig. 3-3). Thus, energy transmitted into a hemisphere was seen by the detector. (See section 3.2.2.)

B-04642. Wilburn: Spectra Notebook, Vol. I; Material, Target and Background Data, Tech. Report No. 8863, Components Research and Development Laboratories, U. S. Army Tank Automotive Center, Warren, Mich., May 1965.

Platform: laboratory

Instrument: Bausch and Lomb 808 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 0.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO

B-04802. Korbel: Thermal and Optical Characteristics of Eniwetok Sand (Final Report), Materials Lab., New York Naval Shipyard, Brooklyn, N. Y., November 1952.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.08 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-04803. Cooper, Derksen: Spectral Reflectance and Transmittance of Forest Fuel Materials (Final Report), Material Lab., New York Naval Shipyard, Brooklyn, N. Y., March 1952.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute
Additional references: 3-2, 3-11, 3-12
Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the integrating sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also.

Instrument 2: Perkin-Elmer infrared spectrometer
Quantity measured: ρ_d, τ_d
Wavelength range: 1.0 to 2.7 μ
Reflectance attachment: Coblentz hemisphere
Reflectance standard: ρ_d data obtained relative to MgO, but converted to absolute; values of τ_d are absolute
Additional references: 3-13, 3-14
Comments: See section 3.2.3.

B-04804. Hovis: Infrared Reflectivity of Some Common Minerals, Appl. Opt., Vol. 5, No. 2 (1966).

Platform: laboratory

Instrument 1: Beckman DK-2 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.5 to 2.5 μ
Reflectance attachment: integrating sphere
Reflectance standard: unspecified
Comments: See section 3.2.2.

Instrument 2: Cary 90 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 2.5 to 6.0 μ
Reflectance attachment: White hemisphere
Reflectance standard: data are absolute
Additional reference: 3-19
Comments: The White attachment is basically a Coblentz type hemisphere (see sec. 3.2.3). The sample was hemispherically illuminated with white light, and the reflected radiation was viewed slightly off normal.

B-04805. Byrne, Mancinelli: Optical Transmittance, Reflectance, and Absorptance of Materials (Final Report), Materials Lab., New York Naval Shipyard, Brooklyn, N. Y., March 1954.

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.22 to 0.4 μ
Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample
Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute
Additional reference: 3-10

Instrument 2: General Electric spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute
Additional references: 3-2, 3-11, 3-12
Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the integrating sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also.

Instrument 3: Perkin-Elmer infrared spectrometer
Quantity measured: ρ_d, τ_d
Wavelength range: 1.0 to 2.7 μ
Reflectance attachment: Coblentz hemisphere
Reflectance standard: ρ_d data obtained relative to MgO, but converted to absolute; values of τ_d are absolute
Additional references: 3-13, 3-14
Comments: See section 3.2.3.

B-04806. Byrne, Schilling: Spectral Reflectance and Transmittance of Interior Fuel Materials (Final Report), Materials Lab., New York Naval Shipyard, Brooklyn, N. Y., November 1953.

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.22 to 0.4 μ
Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample
Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute
Additional reference: 3-10

Instrument 2: General Electric spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute
Additional references: 3-2, 3-11, 3-12
Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the integrating sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also.

Instrument 3: Perkin-Elmer infrared spectrometer
Quantity measured: ρ_d, τ_d
Wavelength range: 1.0 to 2.7 μ
Reflectance attachment: Coblentz hemisphere
Reflectance standard: ρ_d data obtained relative to MgO, but converted to absolute; values of τ_d are absolute
Additional references: 3-13, 3-14
Comments: See section 3.2.3.

B-04079. Edwards et al.: Basic Studies on the Use and Control of Solar Energy (Annual Report, Aug. 1959 to Aug. 1960), Univ. of California, Los Angeles, October 1960.

Platform: laboratory

Instrument 1: Beckman DK-2 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.25 to 2.5 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to MgO, but values converted to absolute
Comments: See section 3.2.2.

Instrument 2: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

Instrument 3: Perkin-Elmer spectrophotometer
Quantity measured: ρ_d
Wavelength range: 1.25 to 15 μ
Reflectance attachment: Hohlraum
Reflectance standard: data are absolute
Comments: See section 3.2.6.

B-05289. Ohlsen, Etemad: Spectral and Total Radiation Data of Various Aircraft Materials, North American Aviation, Inc., Los Angeles Div., Eng. Dept., Los Angeles, Calif., 23 July 1957.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to $MgCO_3$, but values converted to absolute
Comments: See section 3.2.1.

Instrument 2: Original design using a Perkin-Elmer 83 monochromator
Quantity measured: ρ_d
Wavelength range: 1 to 25 μ
Reflectance attachment: Hohlraum
Reflectance standard: Data are absolute
Comments: A Hohlraum device is discussed in section 3.2.6.

B-05370. Betz et al.: Determination of Emissivity and Reflectivity Data on Aircraft Structural Materials, Part I: Techniques for Measurements of Total Normal Emissivity and Reflectivity with Some Data on Copper and Nickel, Document Service Center, Knott Bldg., Dayton, Ohio, October 1956.

Platform: laboratory

Instrument: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.38 to 0.7 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-2, 3-11, 3-12
Comments: See section 3.2.1.

B-013522. Funai, Starr, Streed: Principles of Infrared Camouflage for Low Temperature Targets, Naval Civil Engineering Lab., Port Hueneme, Calif., July 1953, AD 139 720.

Platform: laboratory

Instrument: Beckman IR-3 spectrophotometer
Quantity measured: ρ_d
Wavelength range: 1.8 to 13 μ
Reflectance attachment: Hohlraum
Reflectance standard: data are absolute
Comments: See section 3.2.6.

B-19999, B-20000, B-20001, B-20002. Reflectance of Target and Background Materials, unpublished data from the Air Force Target Signature Measurement Program, Willow Run Laboratories, Institute of Science and Technology, The University of Michigan, Ann Arbor, 1967.

Platform: laboratory

Instrument: Beckman DK-2 spectrophotometer
Quantity measured: ρ_d, τ_d
Wavelength range: 0.28 to 2.6 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO for ρ_d, but values of τ_d are absolute
Comments: For transmittance measurements, the sample was positioned at one of the entrance ports of the integrating sphere, and MgO was placed at both the sample and reference ports (cf. fig. 3-3). Thus, energy transmitted into a hemisphere was seen by the detector. See section 3.2.2 also.

3.5. DATA FORMAT

In order to transfer a data curve from a source document to the Target Signature Library, the curve is first semi-automatically digitized and keypunched on IBM cards. Creat care is exercised to preserve all significant details of the original curve except those attributable to instrument noise. Data points are taken in such a way that the new curve formed by connecting the data points with straight lines will duplicate the original curve. In essence, this amounts to taking data points at all significant inflection points on the original curve, so that relatively few data points are required to describe a smooth curve, although many points may be required to describe a highly erratic curve. The keypunched cards are the mechanism for transferring the data to magnetic tape in the Target Signature Library and for printing out data curves in a standard format on a plotting machine.

The header information above each of the data curves includes the curve's identification number, the curve's title, subject codes, and parameter information. The identification number consists of the internal control letter B and eight digits. The first five digits identify the document from which the data were taken. (Section 3.4 lists the documents by control letter and these five digits.) The last three digits of the identification number have been arbitrarily assigned by the Target Signature Analysis Center for retrieval and to identify a particular curve within a given source document. The subject code is a group of letters assigned to each curve to permit retrieval by subject. Each letter represents a specific descriptor, and each curve is assigned as many letters and as many codes as are required to describe it adequately. The Target Signature Subject-Code List (table 1-1) explains these codes. As an example, a curve may be described as follows:

Object measured: loam (BFEA)

Instrumentation: General Electric spectrophotometer (CDB)

Experimental platform: Laboratory (CED)

Quantity measured: Directional reflectance with the specular component included in the measurement (DFAA)

Reflectance standard: MgO (DFCE)

Spectral interval: 0.4 to 0.7 μ (ECB) and 0.7 to 1.5 μ (ECCA)

The conditions of the experiment, called parameter information, are also listed on the printed header in abbreviated form. This information is derived from the original source when possible. For many of the data, very few parameter entries appear either because the source did not document all of the experimental parameters or because some parameters are not applicable to all measurements, e.g., altitude and range are not parameters for laboratory measurements. Table 3-1 is the key for interpreting this parameter information. Figure 3-18 illustrates the angle parameters pertinent to some measurements.

The optical data in this section are arranged according to the subject code most descriptive of the object or sample measured. Since the Target Signature Subject-Code List contains a large number of specific types of target and background categories, it was necessary in some cases to group the data into somewhat broader categories. These are cross-indexed by subject in section 2.

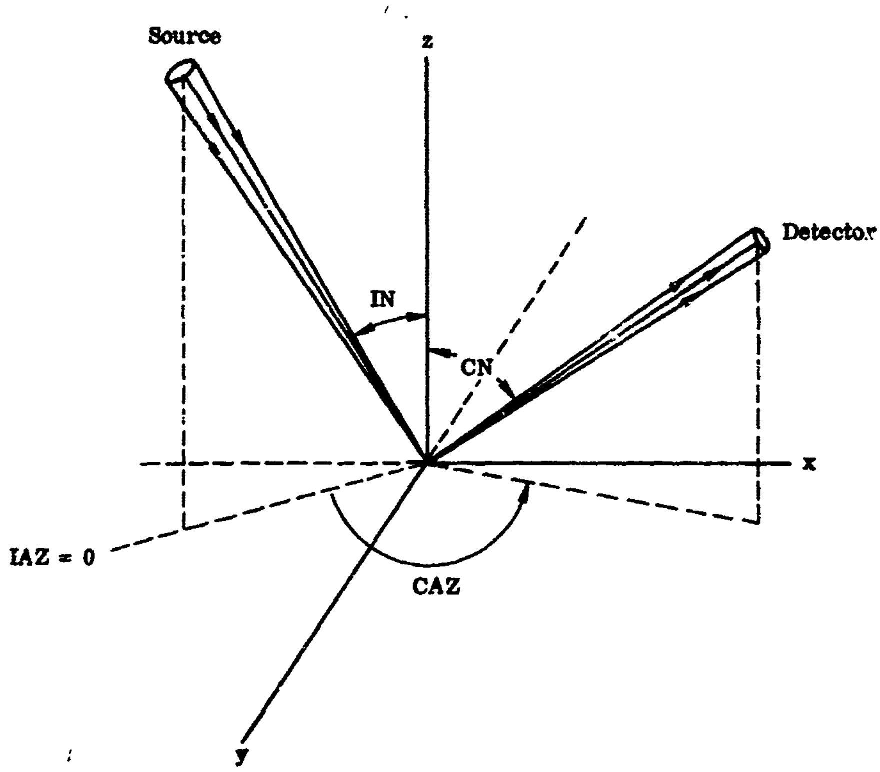


FIGURE 3-18. GEOMETRY FOR SOME SPECIFIED OPTICAL DATA PARAMETERS

TABLE 3-1. OPTICAL DATA PARAMETERS

DATE	Date of measurement (day, month, and year)
TIME	Time of measurement (24-hour clock)
LAT	Latitude of measurement (field measurement) or of location at which specimen was collected (laboratory measurement)
LONG	Longitude of measurement or of location at which specimen was collected, as with LAT
ALT	Altitude of experimental platform (thousands of feet)
RANGE	Slant range (thousands of feet)
DAYS RE	Number of days sample had been removed from its natural environment
IN*	Incidence angle (degrees from normal)
IAZ*	Azimuth of incident radiation (degrees)
CN**	Collection angle (degrees from normal)
CAZ**	Azimuth of collection angle (degrees)
IRR	Type of target irradiation coded as follows: A Sun B Moon C Skylight (extended source) D Laser E Other artificial point sources
OBST	Obstructions in the air that prevent a clear view of the target, coded as follows: A Smoke B Haze C Dust D Sand E Fog F Drizzle G Rain H Snow I Hail
TTEMP	Temperature of target or measured object (°K)
WIND SP	Average wind speed (mph)
WIND DI	Wind direction
CLD	Total cloud cover coded as follows: A 0 to 0.1 B 0.2 to 0.5 C 0.6 to 0.8 D 0.9 to 1.0
VIS	Visibility (miles)
TEMP	Temperature of environment (°F)
DEW PT	Dew point temperature (°F)
N AVE	Number of curves or measurements averaged to make up this curve

*These angles are defined only if the major portion of radiation incident on the target comes from a point source, e.g., the sun (see fig. 3-18).

**These angles are defined when the target is observed from one direction (see fig. 3-18).

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Insert Optical Spectral Data Sheets Here

4
OPTICAL REFLECTANCE DISTRIBUTION FUNCTION DATA

The data treated in this section were obtained through a reflectance measurement of a different type than that used for the data of section 3. As pointed out in section 3.1, the term "reflectance" by itself is vague and should not be used unless the exact type of reflectance is indicated. The common concept for reflectance employs a dimensionless quantity, perhaps as a function of wavelength and always between the values 0 and 1 (or 0% and 100%). Further, it is assumed that the total power reflected by a surface is collected and the ratio of this to the total incident power is the reflectance of that surface; however, situations where total powers are involved seldom occur naturally. Laboratory instruments have been built to approximate or simulate the conditions for such a total reflectance measurement, but each type of instrument (sec. 3.2) really measures only its particular type of reflectance.

Section 3.1 contains a derivation of a "general reflectance" ρ', called bidirectional reflectance, which is based on a directional source and a point receiver; thus the problems of collecting all reflected power or illuminating the surface from all directions are avoided. However, ρ' is not really a reflectance. Since the initial publication of that derivation, the symbol ρ' has been changed to f_r and the name from "bidirectional reflectance" to "quadravariate reflectance distribution function" (4RDF) [4-1] (this notation is used in this section). This was necessary because f_r is not simply a ratio of reflected to incident powers but is a measure of power per unit projected solid angle reflected in a given direction to power incident from a given source direction. Thus, f_r with units of reciprocal steradians (sr^{-1}), is not bounded by 0 and 1, and can vary with the source and receiver angles. This is the type of reflectance that occurs naturally and is of most value to the analysis of remote sensory systems.

A formal definition of the reflectance distribution function and some mathematical manipulations of 4RDF are given in section 4.1; section 4.2 contains equations illustrating how the 4RDF data can be applied to sensor systems. A description of the instrument used for collection of 4RDF data is given in section 4.3. The format used for presenting the data in this compilation is explained in section 4.4.

4.1. DEFINITION OF THE REFLECTANCE DISTRIBUTION FUNCTION 4RDF

The definition given here is based on the treatment of reflectance and emissivity in the Handbook of Military Infrared Technology [4-1]. However, the symbols and terminology are those used in reference 4-2.

Consider radiant power incident on an element of surface area δA from direction θ_i, ϕ_i and contained within the a beam of solid angle $d\omega_i$, where θ_i is the polar and ϕ_i the azimuth angle relative to a coordinate system fixed to area δA, as shown in figure 4-1. If the radiant power source has a radiance of $L_i(\theta_i, \phi_i)$ in direction θ_i, ϕ_i, then the power incident on the surface from this source is

$$\delta P_i = L_i(\theta_i, \phi_i) \cos \theta_i \, \delta A \, d\omega_i$$
$$= \delta E(\theta_i, \phi_i) \delta A \qquad (4\text{-}1)$$

where

$$d\omega_i = \sin \theta_i \, d\theta_i \, d\phi_i$$

and

$$\delta E = L_i \, d\omega_i \cos \theta_i$$

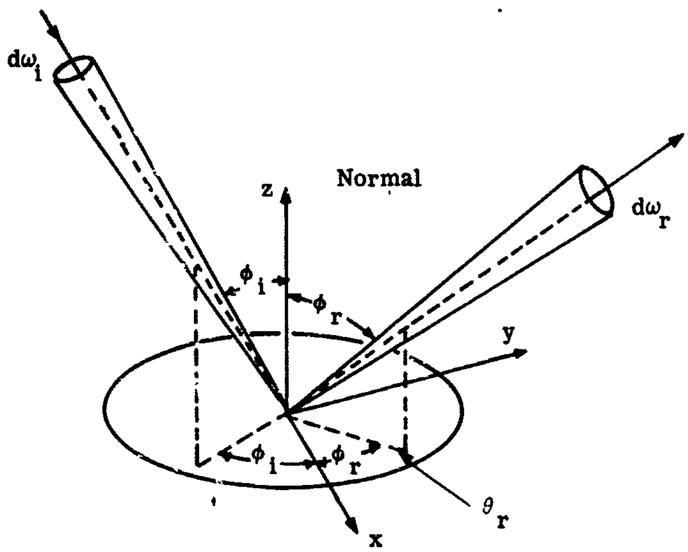

FIGURE 4-1. LOCAL COORDINATE SYSTEM FOR DETERMINING BIDIRECTIONAL REFLECTANCE

Now considering only the incident power δP_i from direction θ_i, ϕ_i, the radiant intensity $\delta I_r(\theta_r, \phi_r)$ of the area δA in direction θ_r, ϕ_r due to reflection or scattering is

$$\delta I_r(\theta_r, \phi_r) = \delta P_i(\theta_i, \phi_i) \, f_r(\theta_i, \phi_i; \theta_r, \phi_r) \cos \theta_r \qquad (4\text{-}2)$$

and since

$$\frac{\delta I_r}{\cos \theta_r \, \delta A} = \delta L_r$$

and

$$\frac{\delta P_i}{\delta A} = \delta E$$

we have the reflected radiance relation

$$\delta L_r(\theta_r, \phi_r) = \delta E(\theta_i, \phi_i) f_r(\theta_i, \phi_i; \theta_r, \phi_r) \qquad (4\text{-}3)$$

In equations 4-2 and 4-3, f_r is defined as the operator that acts on incident power or irradiance to give the reflected radiant intensity or reflected radiance, respectively, of an element δA that is a reflector or scatterer. Explicitly,

$$f_r(\theta_i, \phi_i; \theta_r, \phi_r) = \frac{\delta L_r(\theta_r, \phi_r)}{\delta E(\theta_i, \phi_i)} = \frac{\delta L_r(\theta_r, \phi_r)}{L_i(\theta_i, \phi_i) \cos \theta_i \, d\omega_i} \tag{4-4}$$

(The geometrical factor $\cos \theta_i$ in equation 4-2 does not appear in equation 4-3 because radiance is defined as watts per square centimeter per projected unit solid angle in the direction of propagation.) The reflectance distribution function, f_r, is thus the ratio of reflected radiance to irradiance, each quantity having a direction associated with it. If certain conditions are met, one may apply a theorem of reciprocity [4-3], generally attributed to Helmholtz, which states that the respective directions may be interchanged; i.e.,

$$f_r(\theta_1, \phi_1; \theta_2, \phi_2) = f_r(\theta_2, \phi_2; \theta_1, \phi_1)$$

From equation 4-4:

$$\delta L_r(\theta_r, \phi_r) = f_r \, \delta E(\theta_i, \phi_i) = f_r \frac{\delta P_i(\theta_i, \phi_i)}{\delta A}$$

But, the total power reflected by δA due to δE is

$$P_r = \delta A \int_h \delta L_r(\theta_r, \phi_r) \cos \theta_r \, d\omega_r$$

$$= \delta A \int_h f_r \frac{\delta P_i(\theta_i, \phi_i)}{\delta A} \cos \theta_r \, d\omega_r$$

where the integral is over the hemisphere above δA.

Now, if $\delta P_i(\theta_i, \phi_i)$ is the only source power considered and all its rays are contained within a small solid angle $d\omega_i$, then

$$P_r = P_i(\theta_i, \phi_i) \int_h f_r(\theta_i, \phi_i; \theta_r, \phi_r) \cos \theta_r \, d\omega_r$$

$$\frac{P_r}{P_i(\theta_i, \phi_i)} = \int_h f_r(\theta_i, \phi_i; \theta_r, \phi_r) \cos \theta_r \, d\omega_r$$

Now, it is recognized that

$$\frac{P_r}{P_i(\theta_i, \phi_i)} = \rho_{di}$$

where ρ_{di} is the quantity obtained when a detector is at one port of an integrating sphere and a sample at another port of the sphere is illuminated by a small beam of light from direction θ_i, ϕ_i. Thus,

$$\int_h f_r(\theta_i, \phi_i; \theta_r, \phi_r) \cos \theta_r \, d\omega_r = \rho_{di} \qquad (4\text{-}5)$$

But,

$$\int_h \cos \theta_r \, d\omega_r = \pi$$

therefore,

$$\frac{\int_h f_r(\theta_i, \phi_i; \theta_r, \phi_r) \cos \theta_r \, d\omega_r}{\int_h \cos \theta_r \, d\omega_r} = \frac{\rho_{di}}{\pi}$$

Now, the notation $\overline{f}_r$ is defined as

$$\overline{f}_r(\theta_i, \phi_i) = \frac{\int_h f_r(\theta_i, \phi_i; \theta_r, \phi_r) \cos \theta_r \, d\omega_r}{\int_h \cos \theta_r \, d\omega_r} \qquad (4\text{-}6)$$

where $\overline{f}_r$ is a weighted average of f_r over the hemisphere. Because of the reciprocity theorem,

$$\overline{f}_r(\theta_i, \phi_i) = \overline{f}_r(\theta_r, \phi_r) = \overline{f}_r(\theta, \phi)$$

or, in the former notation

$$\rho_{di} = \rho_{dr} = \rho_d$$

Note, however that

$$\rho_d \neq \overline{f}_r(\theta, \phi)$$

but rather,

$$\rho_d = \pi \overline{f}_r(\theta, \phi)$$

The terms $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ and $\overline{f}_r(\theta, \phi)$ also have the names "quadravariant reflectance distribution function" and "bivariant reflectance distribution function," which are shortened to the acronyms 4RDF and 2RDF, respectively. For a further discussion of f_r and different types of $\overline{f}_r$ derived from it, i.e., f_r averaged over other angles, see reference 4-2, where f_r is termed f_4.

4.2. SOME EQUATIONS FOR THE APPLICATION OF 4RDF DATA

Reflection characteristics of targets and backgrounds are generally used with appropriate equations to predict the operational capabilities of active or semi-active detection or mapping systems. In the past, most of the reflectance data has necessarily been of the ρ_d type, i.e., reflectance, without consideration of how the reflected power is distributed throughout the hemi-

sphere. It should be obvious that generally much better predictions could be made for the operation of such systems if reflectance distribution function data were used. Errors caused by assuming a target to be a diffuse reflector, i.e., taking ρ_d and dividing by π, when in actuality it is a forward scatter or a backscatter, would be completely eliminated.

The price one pays to obtain these better predictions, in addition to the data acquisition costs, is the necessity of working with large amounts of data since $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ or 4RDF varies with both source and receiver directions.* The manner in which 4RDF varies depends on the particular surface considered and the polarization states of the source and receiver, as shown by the data in section 4.5. Much of the variation in 4RDF as a function of receiver angle (θ_r) is unimportant when application is made to active detection or mapping systems where the source and receiver are typically colinear or separated by only a small bistatic angle. For such a system, only those data points where the receiver angle is close, or equal, to the incidence angle would be needed. On the other hand, all the 4RDF data is necessary when application is made to semi-active systems where a flare or the sun is the source and the receiver can be almost anywhere.

The determination of relative contrast in a proposed strip map or other scene could be made very accurately by ranking the $f_r(\theta_r, \phi_r; \theta_i, \phi_i)$ values for all targets and backgrounds that are to be included. An important assumption here is that 4RDF data are available for the targets and backgrounds considered or that mathematical models for these have been formulated from data collected for the basic materials. A similar ranking of ρ_d (or $\bar{f}_r$ or 2RDF in the new notation) values for the same targets and backgrounds could not be depended upon to predict relative contrast unless the angular reflection properties of everything in the scene were the same. This is certainly possible but not very probable.

An important advantage to using 4RDF data lies in the polarization parameters that can be exploited to enhance contrast. Since all four polarization components** usually have different values, there are many combinations—sums, differences, and ratios—that could be used with appropriate instrumentation to change the contrast between specified targets or target classes and their backgrounds. A simple illustration of this is the blinking effect one observes when a polaroid filter is rotated between one's eye and a sun-lighted automobile. Extensive analysis is needed to determine the optimum source polarization plane or planes, receiver analyzer orientations, and/or signal processing; but the effort would pay off, especially when new detection or mapping systems are designed.

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*The reflectance distribution function also varies with wavelength just as ρ_d does; in fact, it may be possible (for certain targets and certain angles) to determine the λ-dependence of f_r data through ρ_d versus λ measurements. Such a procedure would certainly not apply for incidence angles near grazing, for targets with surface textures whose dimensions are comparable to the wavelengths employed, or in spectral regions where absorption bands occur.

**See discussion of polarization at the beginning of section 4.4.

For a given system design, the received power for calculation of signal-to-noise ratios can be computed with 4RDF data in the following manner. By definition from equation 4-4,

$$f_r(\theta_i, \phi_i; \theta_r, \phi_r) = \frac{\delta L_r(\theta_r, \phi_r)}{L_i(\theta_i, \phi_i)d\Omega_i} \tag{4-4a}$$

or

$$\delta L_r(\theta_r, \phi_r) = f_r(\theta_i, \phi_i; \theta_r, \phi_r)L_i(\theta_i, \phi_i)d\Omega_i$$

where subscripts r and i refer to reflected and incident, respectively

$d\Omega_i = d\omega_i \cos \theta_i$ is the projected solid angle through which the source illuminates the target surface

L is radiance

A specified λ and $\Delta\lambda$ are assumed. The radiant power P passing through a remote aperture and coming from a surface with a radiance L is

$$P = LA\Omega$$

where A is the area of the radiating (or reflecting) surface

Ω is the projected solid angle subtended by the receiving aperture

$\Omega = \omega \cos \theta$, where θ is the angle between the surface normal and the receiving aperture normal and ω is the total solid angle. It is assumed here that ω is small and that the receiver is pointed directly toward the area A. Thus, in general, these equations give

$$P(\theta_r, \phi_r) = \left[\int_{\omega_i} f_r(\theta_i, \phi_i; \theta_r, \phi_r)L_i(\theta_i, \phi_i)d\Omega_i\right]A\Omega_r$$

where the integral is over the input solid angle. The term in brackets is the target radiance L_r due to reflection of a source that subtends a solid angle ω_i and has a radiance L_i. A is the area within the field of view subject to L_i, and Ω_r is the projected solid angle of the receiver.

This general equation can be simplified when certain conditions exist: if f_r does not vary over the range of incidence angles considered, it can be moved outside the integral; the remaining integral is the irradiance on the target E. Thus, under these conditions,

$$P(\theta_r, \phi_r) = f_r(\theta_i, \phi_i; \theta_r, \phi_r)E(\theta_i, \phi_i)A\Omega_r$$

At least five different equations can be derived for received power depending on the illumination source and/or the receiver field of view.

Case I. Solar or other source for which irradiance is known

In a selected wavelength band and assuming the field of view to be always fully illuminated,

$$P = f_r(\theta_i, \phi_i; \theta_r, \phi_r)E_s \cos \theta_i \, A_r \frac{\pi}{4}\alpha^2 S_a \tag{4-7}$$

where $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ is the reflectance distribution function of the surface and is a function of source and receiver directions relative to the surface under study

E_s is the irradiance on a surface normal to the source

θ_i is the incident polar angle ($E_s \cos\theta_i$ is thus the target irradiance E)

A_r is the receiver aperture area

α is the total angle field of view

S_a is the loss term to account for atmospheric scattering or absorption

Note that equation 4-7 is independent of range since, when range is decreased, the target area decreases and the receiver solid angle increases.

Case II. Laser or other source with small beam properties arranged coaxially with a receiver

In a selected wavelength band and assuming the illuminated area to be larger than field of view,

$$P = f_r(\theta_i, \phi_i; \theta_r, \phi_r) P_t \frac{\alpha^2}{\gamma^2} \frac{A_r}{R^2} \cos\theta \, S_a^2 \tag{4-8}$$

where P_t is the total transmitted power

R is the range to the target

θ is the polar angle of incidence and reflection

γ is the half-power beam divergence angle of the transmitter and other terms are as in equation 4-7

The loss term is now squared since there is two-way propagation. When the receiver field of view α is smaller than the transmitter beam divergence γ, their ratio correctly weights the P_t term to account for power transmitted but not useful. When α is larger than γ, the ratio term drops out; i.e., for a field of view larger than the beam divergence

$$P = f_r(\theta_i, \phi_i; \theta_r, \phi_r) P_t \frac{A_r}{R^2} \cos\theta \, S_a^2 \tag{4-9}$$

Case III. Laser or other source with small beam properties not arranged coaxially with a receiver

In a selected wavelength band and assuming the illuminated area to be larger than the field of view,

$$P = f_r(\theta_i, \phi_i; \theta_r, \phi_r) P_t \frac{\alpha^2}{\gamma^2} A_r \cos\theta_i \frac{1}{R_t^2} S_{a_t} S_{a_r}$$

where θ_i is the polar angle of incidence

R_t is the range of the target from the transmitter

S_{a_t} and S_{a_r} are loss terms for the paths to the target from the transmitter and to the receiver from the target, respectively

Just as in equation 4-9 when α is larger than γ, their ratio drops out; i.e.,

$$P = f_r(\theta_i, \phi_i; \theta_r, \phi_r)P_tA_r \cos\theta_i \frac{1}{R_t^2}S_{a_t}S_{a_r} \qquad (4\text{-}10)$$

In all of these equations one must be careful that the $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ used applies to the entire target area. If this is not possible, an averaged value should be used based on the relative areas of the several materials or objects comprising the target or filling the field of view.

4.3. DESCRIPTION OF INSTRUMENTATION

The instrument used in the Target Signature Measurements Program (laboratory phase) at The University of Michigan to collect the data presented in this section is called the breadboard gonioreflectometer or "BGR" [4-2]. It is a table-top instrument comprising two radiation sources, a receiver, a sample mount, signal-processing electronics, and chart recorder. One source is a plane-polarized He-Ne laser (Spectra-Physics Model 130B) operating at a wavelength of 0.6328 μm. The other source is a tungsten-quartz iodine lamp with a 250-mm grating monochromator (Bausch and Lomb with slits set for $\Delta\lambda = \pm 50$ Å bandwidth) for operation from 0.3 to 1.4 μ. However, the spectral interval is restricted by the detector in the receiver and the power available from the lamp. The receiver uses an S-1 response photomultiplier (RCA-7102) and has a two-element optical system and field stop that defines a field of view of 7.5 cm at a range of 53 cm and focuses the entrance aperture onto the photocathode. An adjustable iris at the entrance sets the aperture to about 3-cm diameter so that a solid angle of 0.0025 sr is defined for collection of reflected radiation.

Samples are mounted vertically on a hand-operated rotary table set in the path of the source beam to achieve the desired incidence angle. The receiver is mounted on a stand so that the source beam, the sample normal, and the receiver viewing direction all lie in a common plane parallel to the table top. The coordinate system used for a typical measurement is shown in figure 4-2. The choice of the $\phi = 0$ reference line on the sample is arbitrary.

The laser beam is diverged with a negative lens to yield an illuminated spot on the sample, about 2.5-cm diameter at normal incidence; the beam divergence angle (total) is less than 32 mrad. At the exit slits of the monochromator, a two-element optical system and an iris are used to focus a round spot on the sample. The maximum convergence of these rays forming the illuminated spot is less than 40 mrad total angle. The iris is used to reduce the spot size when necessary so that the illuminated area (an ellipse for large incidence angles) is not larger than the field of view of the receiver.

Polaroid filters, HN22 for the visible and HR for the near-IR spectral region, are used to polarize the beam from the monochromator, rotate the polarized beam from the laser, and serve as analyzers in front of the receiver entrance aperture. Inherent sensitivity of the receiver to the polarization of the input beam was checked by rotating the photomultiplier and then the optics about the longitudinal axis of the beam and was found to be negligible in both cases.

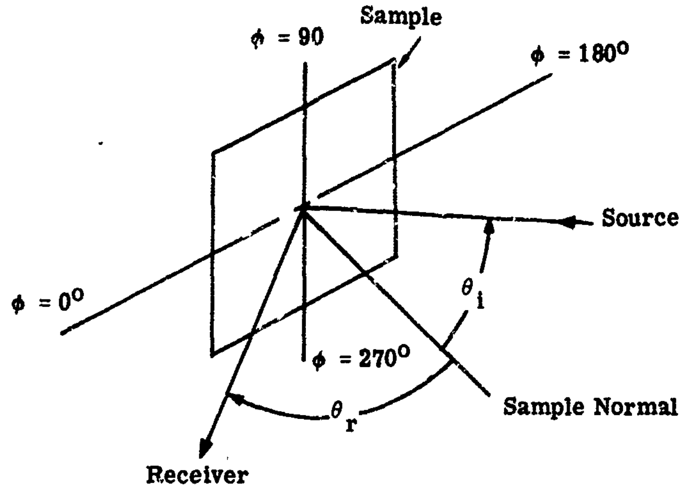


FIGURE 4-2. SAMPLE COORDINATE SYSTEM. Typical for measurements in the $\phi = 0°$ and $\phi = 180°$ planes.

The beams from the sources are chopped mechanically at a 90-Hz rate to allow use of narrowband filtering and a homodyne detector system. Precision electrical attenuators are used in the signal line between the receiver and the filter-homodyne detector so that only a small dynamic range is required for these systems. The attenuators are used over a range of 3 decades, and a test of system linearity over this range with calibrated neutral-density filters gave results of ±3%, which is comparable to the linearity of the photomultiplier alone. The dc output signal from the homodyne detector is recorded on a strip chart, signal vs. time, and the noise can be averaged out for seconds or minutes when necessary.

Calibration of the entire instrument is accomplished in the following manner. A calibrated neutral-density filter of sufficient density is placed between the source and receiver, and a signal proportional to the incident power is obtained. Such calibrations are repeated at half-hour intervals or before and after each run to insure good calibration values. Since the source power is usually constant, as shown by a monitor detector, calibration values are also constant.

The measured values of $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ are obtained for a given set of polarization conditions by use of the equation

$$f_r(\theta_i, \phi_i; \theta_r, \phi_r) = \frac{V_r(\theta_r, \phi_r)K_r}{V_c K_c K_{NDF} \omega_r \cos \theta_r}$$

where V_r is the voltage from the receiver due to reflected power

K_r is precision attenuator setting for voltage V_r

V_c is the calibration voltage (as measured or a linear interpolation if successive values differ)

K_c is the precision attenuator setting for voltage V_c

K_{NDF} is the attenuation of the calibrated neutral density filter used during the calibration measurement

$\omega_r \cos \theta_r$ is the projected solid angle of the receiver as seen from the sample surface

An error analysis considering all factors of the measurement to have normally distributed errors within measured or factory-specified limits resulted in a 50% probable error of ±5% on a stated value of f_r. Most of this error is due to uncertainties in the calibration of the neutral-density filter.

Since spatial coherence of the incident radiation beam may be a significant parameter of the reflection process, a Young's double-slit interference experiment was performed with the laser beam to determine its partial coherence factor. According to coherence theory [4-4] the real part of the complex partial coherence factor $|\gamma_{12}|$ can be obtained under certain conditions by measuring the visibility of fringes produced by a pair of illuminated slits. Visibility is defined here as

$$V = \frac{I_{max} - I_{min}}{I_{max} + I_{min}}$$

where I_{max} is the light intensity at a bright part of the interference pattern and I_{min} is the light intensity at the darker part. The required conditions for such a measurement are (a) that the slit widths be small relative to the distance from slit plane to the fringe observation plane, and (b) that monochromatic radiation be used.

In the experiment, slits of about 0.25-mm width separated by about 0.25 mm were illuminated by the laser beam after passing through the negative diverging lens. The visibility of the fringe pattern was measured at a distance of about 0.75 m with a photomultiplier having a small (0.2 mm) aperture. In moving the slit pair across the width of the laser beam, visibilities or $|\gamma_{12}|$ values between 0.83 to 0.98 were obtained. It was observed that dust particles on the lens caused the lower values of $|\gamma_{12}|$.

4.4. DATA FORMAT

The data are presented in a tabular format with certain parameters listed in a header. The f_r values in the table are those measured as well as one computed value. During the measurement, the source may be linearily polarized or unpolarized and the receiver may or may not employ a linear polarization analyzer. These possible conditions on the source and receiver result in nine different values of f_r if the planes of linear polarization take on orthogonal values relative to a reference plane. The reference plane is usually that formed by the normal to the sample surface (or average surface if it has some contour) and the illuminating beam direction. The nine values of f_r are identified by the letters $\ell\ell$, ℓp, pℓ, pp, ℓt, pt, oℓ, op, and ot, where ℓ = parallel, p = perpendicular, t = no analyzer on the receiver (total signal received). and o = source not polarized (or strictly speaking, randomly polarized). The first letter of each pair refers to the source polarization and the second to that of the receiver. The first four values

of f_r, namely, $f_r(\ell\ell)$, $f_r(\ell p)$, $f_r(p\ell)$, and $f_r(pp)$* are the basic ones, and the others can be derived from them. The computed value given in the tables is $f_r(ot)$, obtained by the equation:

$$f_r(ot) = \frac{f_r(\ell\ell) + f_r(\ell p)}{2} + \frac{f_r(pp) + f_r(p\ell)}{2}$$

The other values can be computed by the following equations:

$$f_r(\ell t) = f_r(\ell\ell) + f_r(\ell p)$$

$$f_r(pt) = f_r(pp) + f_r(p\ell)$$

$$f_r(o\ell) = \frac{f_r(\ell\ell) + f_r(p\ell)}{2}$$

$$f_r(op) = \frac{f_r(pp) + f_r(\ell p)}{2}$$

Each of the four basic components has an ideal value of $1/2\pi = 0.159\ sr^{-1}$, which would apply for a perfectly diffuse reflector with 100% efficiency (no absorption or transmission). This value would also be independent of angle, that is, constant, for such an ideal diffuse reflector.

Because subscripts and lower case letters are not available in the computer printouts used for the data in this section, the notation RDF(LL), RDF(LP), RDF(PL), RDF(PP), and RDF(OT) are used instead of $f_r(\ell\ell)$, etc. The notation 1/SR used in the printout with RDF(LL), etc., refers to the units of RDF, in reciprocal steradians.

The data are arranged according to the prime subject code for each sample derived from the Target Signature Subject-Code List (table 1-1). These codes are prefixed with the letter f, and the filing divider sheets are labeled (f)AEM, etc., to distinguish between these data and those of section 3. The various parts of a typical page of tabular data and header information are shown and identified in table 4-1. Several pages are required to present all the data for a given sample.

Each page of data contains:

(a) Sample number and area/condition number
(b) Title and short description
(c) Subject codes
(d) Data set numbers included on that page
(e) Parameter information: the type of source, the coherence factor, if it applies, and the instrumentation used, the accuracy of the data, the number of data sets averaged, the angles θ_i, ϕ_i, θ_r, ϕ_r, $\beta = |\theta_i - \theta_r|$ if β is fixed, and the wavelength of the source (a fixed quantity)

*The complete notation for the reflectance distribution function with all angles and polarization parameters included is $f_r(\theta_i, \phi_i, \ell; \theta_r, \phi_r, \ell)$, $f_r(\theta_i, \phi_i, \ell; \theta_r, \phi_r, p)$, etc., where items to the left of the semicolon within the parentheses refer to the source and those to the right to the receiver.

(f) Data set numbers for each measured quantity

(g) A table of measured RDF values, one computed RDF value, and the variable angle

(h) Repeat of (f) and (g) when one of fixed angles changes value

Identification is provided by a letter (see table 4-2) to designate the agency that supplied the measurement data, followed by a 5-digit number that is assigned by the TSAC library to each sample, material, or object that has been measured. These six characters are followed by a dash and 3 digits designating a particular numbered area on the sample or designating (by an arbitrary number) a changed condition of the sample; that is, a new area/condition number would be assigned if the sample had been clean and was allowed to become dirty. The letter, the sample number, and the area/condition number comprise the ID number for that sample. Note the parts of this number identified in table 4-1. Data set numbers are assigned to a group of data points that has in common one variable, all other parameters including polarization being fixed. For example, one data set might contain RDF(LL) data where θ_i, ϕ_i, ϕ_r and the polarization parameters are fixed and θ_r is variable; when ϕ_r is changed to some other value a new data set number is assigned, etc. If the angle parameters are the same but the wavelength or the source type is changed, a new data set number is again assigned. Note the assignment of data set numbers in table 4-1. A similar rule is followed in assigning data set numbers for data when the bistatic angle $\beta = |\theta_i - \theta_r|$ is fixed during the measurement, although in this case two angles are varying at once.

Since the f_r data (see sec. 2 for a cross index) are given in a tabular format, several graphs of f_r versus θ_r are included here to help the reader visualize the spatial variation of f_r for various incidence angles. Four different types of materials were chosen, and for reasons of clarity the function plotted is f_r(ot) rather than the four basic components; i.e., for these data the source is unpolarized and no analyzer is used on the receiver. A polar coordinate system was chosen as the graphic format because the resulting figure is symbolic of the reflection or scattering process. Figures 4-3a and b show the somewhat diffuse reflection distribution function of 3M white velvet paint, and figure 4-4 shows data for an orange-colored nylon cloth which exhibits both forward scatter and backscatter. Logarithmic scales are used in figures 4-5 and 4-3a and b to accommodate the large dynamic range of the forward-scatter values of an olive drab paint and a mulberry leaf, respectively.

TABLE 4-1. IDENTIFICATION OF ITEMS ON TYPICAL DATA PAGE

Sample No. Area/Condition No.

A01027-003

ID No.

Prefix Letter for Measuring Agency (Table 4—2)

TITLE
O.D. PAINT USED ON MAZ-200 7 TON TRUCK, 1 COAT APPLIED
ON 2 COATS OF ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM.
SAMPLE PREPARED AT U. OF M.

SUBJECT CODES
AEMB ECBBI

See table 1—1

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

See table 1—1

Source Coherence See table 1—1

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

Change of ϕ_r

Units of RDF

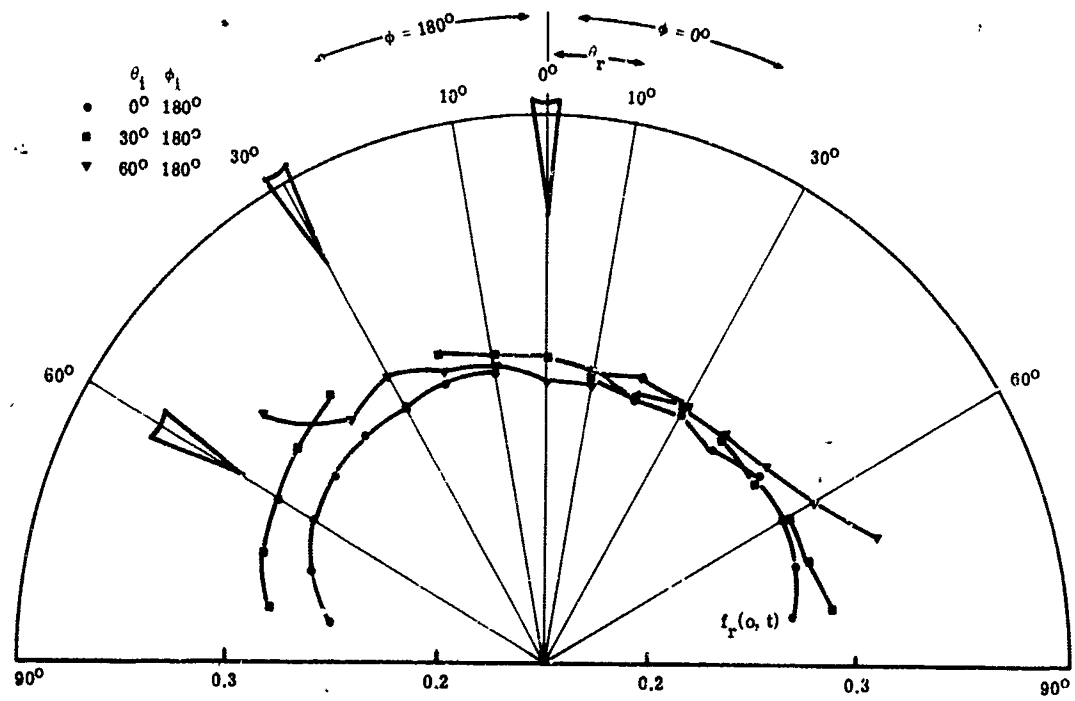
DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1127	.0050	.0042	.1149	.118
	20.00	.0384	.0043	.0039	.0411	.044
	30.00	.0170	.0041	.0039	.0189	.022
	40.00	.0107	.0041	.0039	.0119	.015
	50.00	.0086	.0043	.0038	.0094	.013
	60.00	.0077	.0042	.0036	.0084	.012
	70.00	.0078	.0045	.0037	.0080	.012
	80.00	.0072	.0041	.0035	.0081	.011

New Data Set No.

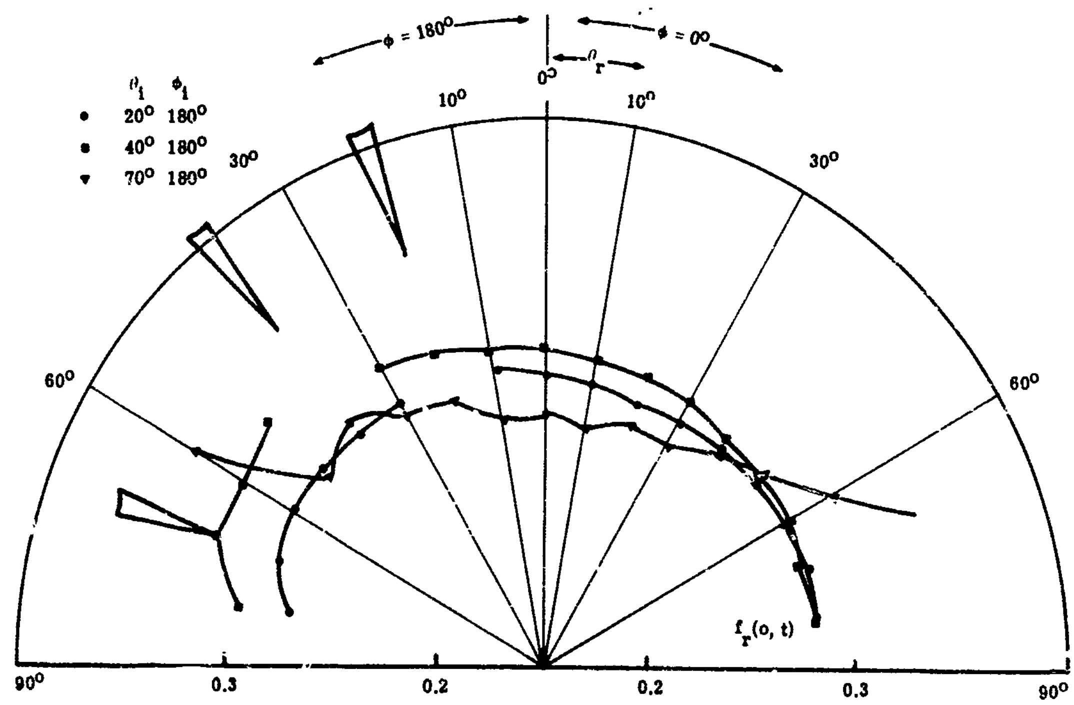
DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1124	.0052	.0042	.1175	.120
	20.00	.0384	.0042	.0039	.0417	.044
	30.00	.0170	.0035	.0039	.0184	.021
	40.00	.0107	.0039	.0039	.0116	.015
	50.00	.0086	.0042	.0038	.0097	.013
	60.00	.0077	.0042	.0036	.0085	.012
	70.00	.0078	.0045	.0037	.0082	.012
	80.00	.0072	.0044	.0035	.0085	.012

TABLE 4-2. CODE LIST FOR MEASURING AGENCY

Prefix Letters	Organization
A	The University of Michigan Target Signature Measurements
B	The University of Michigan Target Signature Analysis Center Document Library Reports
C	The University of Michigan C. Olson
D	National Bureau of Standards
E	Texas Instruments Inc.



(a) Incidence angle = 0°, 30°, 60°.



(b) Incidence angle = 20°, 40°, 70°.

FIGURE 4-3. REFLECTANCE DISTRIBUTION FUNCTION $f_r(o, t)$ VS. RECEIVER ANGLE θ FOR 3M WHITE VELVET PAINT. $\lambda = 1.06\ \mu m$. Sample ID No. A01290-001. Arrowheads indicate value of θ_i, incidence angle of source.

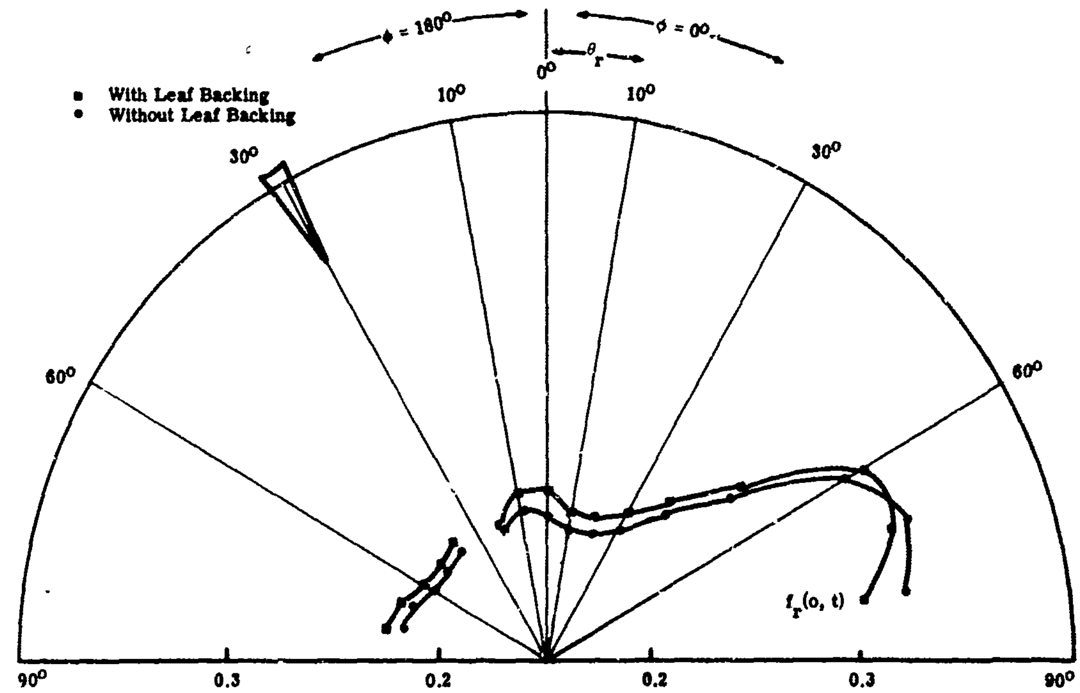


FIGURE 4-4. REFLECTANCE DISTRIBUTION FUNCTION $f_r(o, t)$ VS. RECEIVER ANGLE θ_r FOR ORANGE-COLORED NYLON CLOTH. $\lambda = 0.6328$ μm. Sample ID No. A01059-14 and -15. Arrowheads indicate value of θ_i, incidence angle of source.

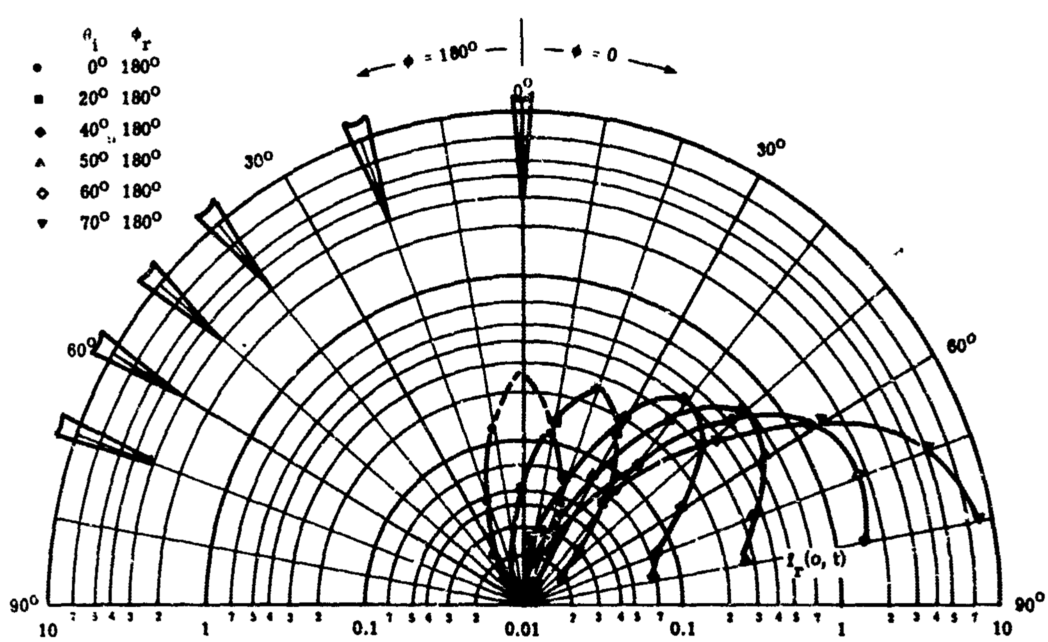
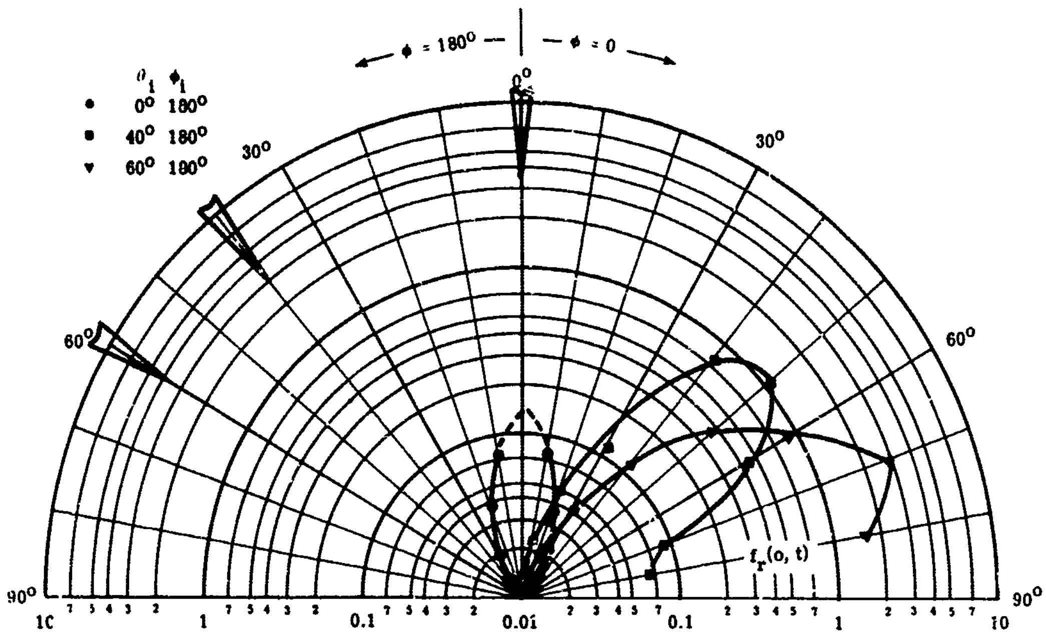
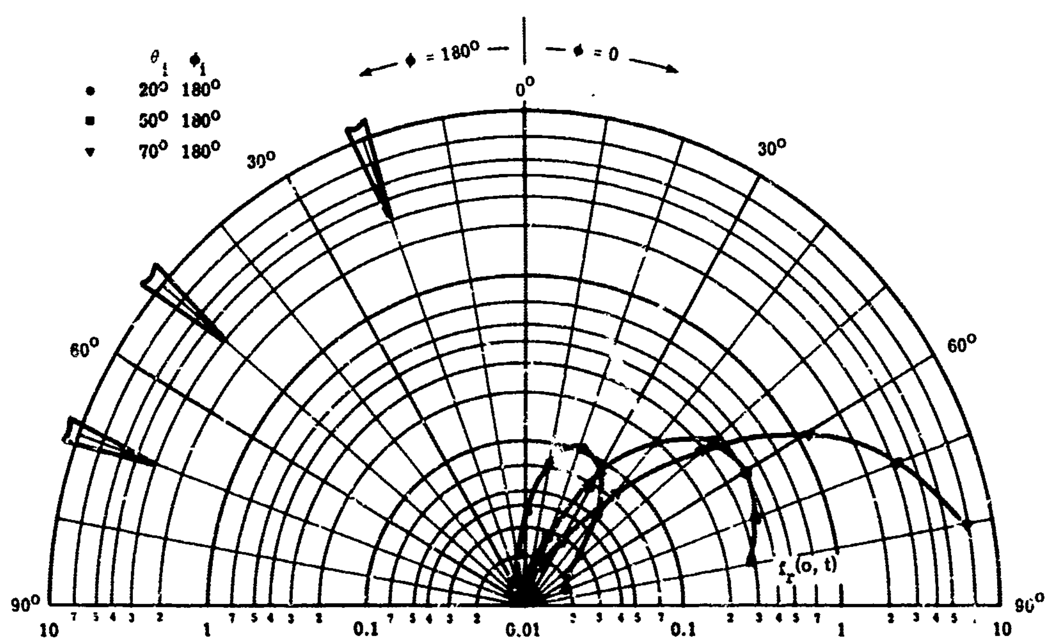


FIGURE 4-5. REFLECTANCE DISTRIBUTION FUNCTION $f_r(o, t)$ VS. RECEIVER ANGLE θ_r FOR AN OLIVE DRAB PAINT. $\lambda = 0.6328$ μm. Sample ID No. A01027-003. Arrowheads indicate value of θ_i, incidence angle of source.



(a) Incidence angle = 0°, 40°, 60°.



(b) Incidence angle = 20°, 50°, 70°.

FIGURE 4-6. REFLECTANCE DISTRIBUTION FUNCTION $f_r(o, t)$ VS. RECEIVER ANGLE θ_r FOR A MULBERRY LEAF. $\lambda = 0.6328$ μm. Sample ID No. A01324-001. Arrowheads indicate value of θ_i, incidence angle of source.

4.5. REFERENCES FOR SECTION 4

4-1. W. L. Wolfe (ed.), Handbook of Military Infrared Technology, Office of Naval Research, Washington, D. C., 1965, Chapter 2, p. 25.

4-2. Target Signature Measurements (U), Final Report, Rept. 8047-28-F, AFAL-TR-68-198, Willow Run Laboratories of the Institute of Science and Technology, The University of Michigan, Ann Arbor, September 1968 (CONFIDENTIAL). AD 932 735

4-3. A. T. DeHoop, A Reciprocity Theorem for the Electromagnetic Field Scattered by an Obstacle, Appl. Sci. Res., Sec. B, Vol. 8, p. 135, 1960.

4-4. M. Born and E. Wolf, Principles of Optics, Macmillan, 1964, Chapter 10.

AC1C57-C14

TITLE
NYLON CLOTH USED FOR PERSONNEL PARACHUTES, PLAIN WEAVE WITH
RIB STOP PATTERN, 1.1 OZ MAX WT/SQ YD, SHRUNK,
MIL-C-7020(ASG), TYPE I, UNDYED, (1 LAYER).
SUBJECT CODES
AAKAB ECBBJ
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1053	.0141	.0139	.1308	.132
	10.00	.0913	.0142	.0145	.1156	.118
	20.00	.0942	.0168	.0172	.1182	.123
	30.00	.1055	.0228	.0220	.1326	.141
	40.00	.1210	.0302	.0285	.1539	.167
	50.00	.1528	.0433	.0386	.2046	.220
	60.00	.2035	.0656	.0571	.3020	.314
	70.00	.2634	.0928	.0826	.4390	.439
	80.00	.1969	.0785	.0635	.4049	.372

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SP)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1053	.0141	.0139	.1308	.132
	10.00	.1382	.0143	.0144	.1657	.166
	20.00	.1125	.0145	.0144	.1474	.144
	30.00					
	40.00	.1067	.0182	.0163	.1542	.148
	50.00	.0897	.0194	.0168	.1411	.133
	60.00	.0882	.0217	.0174	.1300	.129
	70.00	.1009	.0250	.0196	.1437	.145
	80.00	.0985	.0261	.0209	.1246	.135

AC1058-014

TITLE
NYLON CLOTH USED FOR PERSONNEL PARACHUTES, PLAIN WEAVE WITH RIB STOP PATTERN, 1.1 OZ MAX WT/SQ YD, SHRUNK, MIL-C-7020(ASG), TYPE I, OLIVE GREEN (ARMY 106), (1 LAYER).

SUBJECT CODES
AAKAB ECBBI

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0549	.0048	0050	.0624	.064
	10.00	.0467	.0053	.0053	.0597	.059
	20.00	.0468	.0059	.0058	.0656	.062
	30.00	.0483	.0075	.0071	.0753	.069
	40.00	.0496	.0089	.0089	.0866	.077
	50.00	.0535	.0116	.0110	.1065	.091
	60.00	.0626	.0178	.0164	.1570	.127
	70.00	.0613	.0208	.0168	.1915	.145
	80.00	.0516	.0166	.0133	.1933	.137

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0549	.0048	.0050	.0624	.064
	10.00	.0502	.0046	.0048	.0532	.056
	20.00	.0423	.0046	.0045	.0424	.047
	30.00					
	40.00	.0405	.0051	.0047	.0403	.045
	50.00	.0369	.0056	.0050	.0390	.043
	60.00	.0351	.0063	.0052	.0395	.043
	70.00	.0373	.0069	.0053	.0424	.046
	80.00	.0368	.0087	.0057	.0452	.048

AC1059-014

TITLE
    NYLON CLOTH USED FOR PERSONNEL PARACHUTES, PLAIN WEAVE WITH
    RIB STOP PATTERN, 1.1 OZ MAX WT/SQ YD, SHRUNK,
    MIL-C-7020(ASG), TYPE I, ORANGE (FED 12197) (1 LAYER).
SUBJECT CODES
    AAKAB   ECBBD
DATA SET NUMBERS
    1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
    SOURCE= DKI   GAMMA(0)=.90   INSTRUMENTATION= CLA
    ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
    THETA(I)= 30.00   PHI(I)=180.00   WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1000	.0159	.0179	.1253	.130
	10.00	.0837	.0173	.0184	.1115	.115
	20.00	.0866	.0199	.0206	.1135	.120
	30.00	.0967	.0260	.0262	.1271	.138
	40.00	.1209	.0364	.0358	.1566	.175
	50.00	.1454	.0509	.0487	.2001	.223
	60.00	.1885	.0786	.0710	.3087	.323
	70.00	.2094	.0852	.0719	.3615	.364
	80.00	.1791	.0739	.0564	.3774	.343

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1000	.0159	.0179	.1253	.130
	10.00	.1040	.0149	.0174	.1339	.135
	20.00	.0909	.0148	.0161	.1198	.121
	30.00					
	40.00	.0915	.0180	.0183	.1278	.128
	50.00	.0819	.0202	.0197	.1264	.124
	60.00	.0813	.0228	.0204	.1204	.122
	70.00	.0932	.0259	.0225	.1351	.138
	80.00	.0935	.0261	.0218	.1373	.139

AC1C59-C15

TITLE
NYLCN CLCTH USEC FOR PERSCNNEL PARACHUTES, PLAIN WEAVE WITH RIB STCP PATTERN, 1.1 CZ MAX WT/SQ YC, SHRUNK, MIL-C-7020 (ASG),TYPE I,CRANGE(FEC 1219) (CN 4 LAYERS CF SYCAMORE LEAV.

SUBJECT CODES
AAKAB ECBBD

CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATICN
SOURCE= CKI GAMMA(0)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 30.0C PHI(I)=18C.00 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1198	.C207	.0216	.1392	.151
	1C.00	.0982	.0226	.0229	.1191	.131
	2C.CC	.0985	.C260	.0262	.1214	.136
	3C.00	.1C87	.C324	.0319	.1357	.154
	4C.00	.1272	.0424	.04C2	.1627	.186
	5C.00	.1544	.C581	.0538	.2145	.240
	6C.00	.2C38	.0881	.0760	.3229	.345
	7C.00	.2C29	.C844	.0683	.3342	.345
	8C.CO	.1639	.C678	.0492	.3225	.302

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.1198	.0207	.0216	.1392	.151
	1C.C0	.1173	.0195	.0200	.1446	.151
	2C.00	.1C32	.C166	.0196	.1179	.129
	3C.00					
	40.C0	.1045	.0214	.0216	.1271	.137
	5C.C0	.0946	.0235	.0228	.1280	.134
	6C.00	.C937	.C259	.0236	.1200	.132
	7C.C0	.1C58	.C281	.0245	.1340	.146
	8C.00	.1114	.C291	.0233	.1464	.155

AC1060-014

TITLE
NYLON CLOTH USED FOR PERSONNEL PARACHUTES, PLAIN WEAVE WITH RIB STOP PATTERN, 1.1 OZ MAX WT/SQ YD, SHRUNK, MIL-C-7020(ASG), SAND (AF 1005) (1 LAYER).

SUBJECT CODES
AAKAB ECBBF

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0836	.0073	.0074	.0946	.096
	10.00	.0605	.0072	.0075	.0698	.072
	20.00	.0604	.0087	.0090	.0692	.074
	30.00	.0666	.0124	.0123	.0816	.086
	40.00	.0713	.0171	.0158	.0987	.101
	50.00	.0884	.0263	.0236	.1352	.137
	60.00	.1272	.0493	.0429	.2252	.222
	70.00	.1392	.0528	.0449	.2759	.256
	80.00	.1098	.0341	.0251	.2390	.204

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0836	.0073	.0074	.0946	.096
	10.00	.0844	.0070	.0070	.1044	.101
	20.00	.0687	.0068	.0068	.0818	.082
	30.00					
	40.00	.0644	.0077	.0078	.0812	.081
	50.00	.0528	.0074	.0073	.0741	.071
	60.00	.0511	.0081	.0074	.0625	.065
	70.00	.0599	.0091	.0075	.0706	.074
	80.00	.0612	.0095	.0064	.0734	.075

AC1061-014

TITLE
NYLON CLOTH USED FOR CARGO PARACHUTES, DOBBY WEAVE, 2.25 OZ MAX WT/SQ YD, UNSHRUNK, MIL-C-7350(ASG), TYPE I, OLIVE GREEN (ARMY 106) (1 LAYER).

SUBJECT CODES
AAKAB ECBBI

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0395	.0057	.0059	.0423	.047
	10.00	.0401	.0070	.0072	.0455	.050
	20.00	.0448	.0094	.0097	.0541	.059
	30.00	.0507	.0138	.0139	.0696	.074
	40.00	.0424	.0150	.0143	.0662	.069
	50.00	.0388	.0165	.0154	.0704	.071
	60.00	.0396	.0185	.0168	.0809	.078
	70.00	.0405	.0191	.0169	.0933	.085
	80.00	.0479	.0174	.0145	.1040	.092

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0395	.0057	.0059	.0423	.047
	10.00	.0409	.0051	.0054	.0461	.049
	20.00	.0428	.0049	.0048	.0452	.049
	30.00					
	40.00	.0314	.0045	.0043	.0317	.036
	50.00	.0240	.0043	.0039	.0253	.029
	60.00	.0215	.0044	.0038	.0203	.025
	70.00	.0223	.0046	.0037	.0210	.026
	80.00	.0261	.0049	.0037	.0244	.030

AC151C-C01

TITLE
C.D. CANVAS TARPAULIN, 24 IN. X 20-1/2 IN., TAKEN FRCM A U.S. 18 TON M4A HIGH SPEED TRACTCR.
SUBJECT CCDES
AEE ECBBI
CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	1 RCF(LL) (1/SR)	2 RCF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.CC					
	1C.CO	.C16	.CC7	.006	.016	.023
	2C.00	.C14	.006	.006	.015	.021
	3C.00	.C13	.006	.006	.014	.019
	4C.CO	.C12	.0C6	.006	.014	.019
	5C.CO	.C12	.0C6	.006	.015	.020
	6C.00	.C11	.0C7	.006	.016	.020
	7C.0C	.C11	.007	.007	.018	.022
	8C.0C	.C11	.0C7	.007	.019	.022

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	5 RCF(LL) (1/SR)	6 RCF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.CO					
	1C.CO	.C17	.0C7	.007	.016	.024
	2C.00	.C15	.0C6	.006	.015	.021
	3C.CC	.C14	.0C6	.006	.015	.021
	4C.00	.C13	.0C6	.006	.015	.020
	5C.CO	.C12	.0C7	.007	.016	.021
	6C.00	.C12	.007	.007	.017	.022
	7C.00	.C12	.008	.007	.019	.023
	8C.CO	.C13	.008	.008	.023	.026

(f) AEE 2

AC1510-001

TITLE
O.D. CANVAS TARPAULIN, 24 IN. X 20-1/2 IN., TAKEN FROM A U.S. 18 TON M4A HIGH SPEED TRACTOR.
SUBJECT CODES
AEE ECBBI
DATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 45.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	5.00	.011	.006	.006	.014	.018
	15.00	.010	.006	.006	.015	.019
	25.00	.010	.006	.006	.016	.019
	35.00	.010	.006	.006	.018	.020
	45.00	.010	.007	.006	.021	.022
	55.00	.011	.007	.007	.025	.025
	65.00	.012	.008	.007	.030	.028
	75.00	.016	.009	.008	.037	.035
	85.00	.023	.011	.010	.053	.049

DATA SET NUMBER		13	14	15	16	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	5.00	.012	.006	.006	.013	.018
	15.00	.013	.006	.006	.014	.019
	25.00	.015	.007	.007	.015	.022
	35.00	.018	.007	.007	.017	.024
	45.00					
	55.00	.021	.009	.009	.020	.029
	65.00	.019	.009	.009	.019	.028
	75.00	.019	.009	.009	.020	.028
	85.00	.019	.010	.009	.022	.030

(f)AEG 1

AO1329-001

TITLE
OLD CONCRETE (20 YEARS) FROM WILLOW RUN AIRPORT APRON.
SUBJECT CODES
AEG
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DFI GAMMA(O)=.50 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.0654	.0491	.0439	.0704	.114
	20.00	.0603	.0479	.0425	.0658	.108
	30.00	.0582	.0450	.0438	.0605	.104
	40.00	.0551	.0442	.0424	.0602	.101
	50.00	.0497	.0435	.0399	.0601	.097
	60.00	.0502	.0424	.0412	.0590	.096
	70.00	.0469	.0418	.0399	.0600	.094
	80.00	.0458	.0412	.0399	.0608	.094

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.0640	.0449	.0430	.0626	.107
	20.00	.0609	.0446	.0427	.0612	.105
	30.00	.0552	.0408	.0400	.0556	.096
	40.00	.0530	.0419	.0400	.0562	.096
	50.00	.0509	.0413	.0394	.0564	.094
	60.00	.0482	.0422	.0390	.0593	.094
	70.00	.0442	.0396	.0370	.0567	.089
	80.00	.0391	.0372	.0330	.0558	.083

(f)AEG 2

AC1329-001

TITLE
OLD CONCRETE (20 YEARS) FROM WILLOW RUN AIRPORT APRON.
SUBJECT CODES
AEG
DATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATION
SOURCE= DKI GAMMA(C)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 20.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0612	.0481	.0433	.0648	.109
	10.00	.0583	.0443	.0434	.0605	.103
	20.00	.0544	.0432	.0420	.0594	.100
	30.00	.0493	.0430	.0393	.0605	.096
	40.00	.0499	.0418	.0415	.0600	.097
	50.00	.0473	.0418	.0393	.0602	.094
	60.00	.0460	.0403	.0406	.0626	.095
	70.00	.0488	.0417	.0405	.0694	.100
	80.00	.0461	.0399	.0384	.0703	.097

DATA SET NUMBER		13	14	15	16	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0612	.0481	.0433	.0648	.109
	10.00	.0671	.0497	.0447	.0703	.116
	20.00					
	30.00	.0663	.0463	.0434	.0655	.111
	40.00	.0633	.0462	.0442	.0631	.108
	50.00	.0576	.0427	.0412	.0572	.099
	60.00	.0541	.0423	.0414	.0567	.097
	70.00	.0502	.0417	.0393	.0541	.093
	80.00	.0450	.0384	.0355	.0526	.086

AC1329-001

TITLE
    OLD CONCRETE (20 YEARS) FROM WILLOW RUN AIRPORT APRON.
SUBJECT CODES
    AEG
DATA SET NUMBERS
    17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATION
    SOURCE= DKI   GAMMA(0)=.90   INSTRUMENTATION= CLA
    ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
    THETA(I)= 40.00   PHI(I)=180.00   WAVELENGTH= .633

DATA SET NUMBER		17	18	19	20	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0556	.0440	.0427	.0600	.101
	10.00	.0498	.0440	.0400	.0611	.097
	20.00	.0507	.0419	.0416	.0603	.097
	30.00	.0479	.0423	.0408	.0631	.097
	40.00	.0481	.0410	.0410	.0655	.098
	50.00	.0492	.0434	.0398	.0726	.102
	60.00	.0478	.0411	.0396	.0742	.101
	70.00	.0452	.0387	.0355	.0774	.098
	80.00	.0471	.0357	.0347	.0837	.101

DATA SET NUMBER		21	22	23	24	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0556	.0440	.0427	.0600	.101
	10.00	.0594	.0462	.0441	.0618	.106
	20.00	.0646	.0495	.0455	.0698	.115
	30.00	.0726	.0503	.0479	.0748	.123
	40.00					
	50.00	.0741	.0506	.0486	.0711	.122
	60.00	.0717	.0502	.0489	.0703	.121
	70.00	.0635	.0468	.0445	.0599	.107
	80.00	.0553	.0411	.0408	.0543	.096

AC1329-C01

TITLE
CLD CCNCRETE (2C YEARS) FRCM WILLCW RUN AIRPCRT APRCN.
SUBJECT CCDES
AEG
CATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 50.CC PHI(I)=18C.CC WAVELENGTH= .633

DATA SET NUMBER		25	26	27	28	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.C5C5	.C442	.04C3	.0610	.098
	1C.CC	.C5C8	.C427	.0426	.C6CO	.098
	2C.CO	.0480	.C419	.04C5	.0625	.096
	3C.OC	.C466	.C4C9	.C4C9	.0649	.097
	4C.00	.0493	.C427	.0416	.0705	.102
	5C.CO	.C492	.C411	.0392	.C782	.104
	6C.00	.0459	.C391	.0356	.0836	.102
	7C.CO	.0484	.C374	.C349	.0914	.106
	8C.CO	.C513	.C35C	.C329	.0997	.109

DATA SET NUMBER		29	30	31	32	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.C5C5	.C442	.04C3	.0610	.098
	1C.00	.C566	.C455	.C435	.C621	.1C4
	2C.CO	.C62C	.0472	.0458	.0647	.110
	3C.CC	.0678	.C527	.0473	.0741	.121
	4C.00	.0776	.0573	.0513	.0814	.134
	5C.CO					
	6C.CO	.C832	.C547	.0538	.0818	.137
	7C.00	.079C	.056C	.0535	.0757	.132
	8C.00	.C668	.C495	.0473	.0633	.113

AC1329-C01

TITLE
CLD CCNCRETE (2C YEARS) FRCM WILLCW RUN AIRPCRT APRCN.
SUBJECT CODES
AEG
DATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 4C
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 60.0C PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	33 RDF(LL) (1/SR)	34 RDF(PL) (1/SR)	35 RDF(LP) (1/SR)	36 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.C477	.0418	.0393	.0599	.094
	1C.0C	.0443	.C399	.0372	.0614	.091
	2C.00	.0444	.C4C1	.0372	.0618	.092
	3C.CO	.0467	.C432	.04C8	.0715	.101
	4C.CO	.0467	.0413	.0382	.0759	.101
	5C.00	.0449	.0386	.C352	.0835	.101
	6C.00	.C5C4	.0376	.0356	.0941	.1C9
	7C.CO	.0547	.C328	.0330	.1065	.113
	8C.00	.0609	.0310	.0301	.1234	.123

DATA SET NUMBER PHI(R) =18C.0	THETA(R) (DEG)	37 RDF(LL) (1/SR)	38 RDF(PL) (1/SR)	39 RDF(LP) (1/SR)	40 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00	.C477	.0418	.0393	.0599	.094
	1C.CC	.C498	.044C	.0399	.0621	.098
	2C.00	.0576	.C454	.0438	.0598	.103
	3C.CC	.0641	.C49C	.0467	.0667	.113
	4C.CO	.0723	.C568	.0506	.0778	.129
	5C.00	.C872	.C625	.0561	.0886	.147
	6C.CO					
	7C.00	.0969	.C648	.0622	.0937	.159
	8C.CC	.0833	.0618	.0571	.0842	.143

AC1329-C01

TITLE
CLD CONCRETE (2C YEARS) FRCM WILLCW RUN AIRPCRT APRCN.
SUBJECT CODES
AEG
CATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 70.CC PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER		41	42	43	44	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.C458	.C4C1	.0385	.0589	.092
	1C.CC	.046C	.C378	.0396	.C593	.091
	2C.CC	.0471	.C4CC	.04C2	.C671	.097
	3C.OC	.C459	.C385	.0381	.C721	.097
	4C.00	.0458	.C248	.0365	.0779	.093
	5C.0C	.C492	.C353	.0348	.0903	.105
	6C.CC	.C528	.C34C	.0320	.1060	.112
	7C.OC	.C667	.C313	.0316	.1348	.132
	8C.OC	.C997	.C3C6	.03C8	.1889	.175

DATA SET NUMBER		45	46	47	48	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0458	.C4C1	.C385	.0589	.092
	1C.CO	.05C4	.0414	.0417	.C572	.095
	2C.CC	.C51C	.C442	.04C4	.0609	.098
	3C.00	.0593	.C468	.0456	.0625	.107
	4C.00	.0675	.C498	.0496	.C693	.118
	5C.CO	.08C2	.C623	.0556	.0847	.141
	6C.CC	.1C19	.C716	.0648	.1025	.170
	7C.CO					
	8C.CO	.12C3	.0793	.0761	.1134	.195

AC1194-C01

TITLE
CHRCME-PLATED GLASS BEADS, 3 MM DIA. BEADS IN REGULAR ARRAY, CN 4 IN. SQ. ALUMINUM SUBSTRATE.
SUBJECT CODES
AEL CJAG
DATA SET NUMBERS
1, 2, 3, 4
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.00	.0962	.0039	.0035	.0984	.101
	2C.00	.0482	.0036	.0033	.0464	.051
	3C.00	.0321	.0035	.0036	.0339	.037
	4C.00	.0322	.0036	.0037	.0365	.038
	5C.00	.0326	.0038	.0041	.0439	.042
	6C.00	.0344	.0039	.0044	.0517	.047
	7C.00	.0415	.0032	.0046	.0698	.060
	8C.00	.0335	.0013	.0023	.0644	.051

AC1194-C01

TITLE
CHROME-PLATED GLASS BEADS, 3 MM DIA. BEADS IN REGULAR ARRAY, ON 4 IN. SQ. ALUMINUM SUBSTRATE.

SUBJECT CODES
AEL CJAG

DATA SET NUMBERS
5, 6, 7, 8, 9, 10, 11, 12

PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)= 180.0 WAVELENGTH= .633

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0333	.0044	.0037	.0358	.039
	10.00	.0334	.0046	.0039	.0413	.042
	20.00	.0332	.0052	.0040	.0467	.045
	30.00	.0340	.0057	.0045	.0559	.050
	40.00	.0370	.0067	.0057	.0725	.061
	50.00	.0714	.0111	.0097	.1571	.125
	60.00	.0387	.0067	.0073	.1059	.079
	70.00	.0387	.0076	.0097	.1492	.103
	80.00	.0466	.0022	.0027	.2975	.175

DATA SET NUMBER		9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0333	.0044	.0037	.0358	.039
	10.00	.0320	.0044	.0036	.0356	.038
	20.00	.0360	.0046	.0038	.0353	.040
	30.00	.0461	.0050	.0055	.0383	.047
	40.00					
	50.00	.0592	.0050	.0043	.0502	.059
	60.00	.0749	.0038	.0036	.0625	.072
	70.00	.0324	.0028	.0027	.0307	.034
	80.00	.0120	.0015	.0017	.0099	.013

AC1272-C01

TITLE
CHROME-PLATED GLASS BEADS, 3 MM DIA. BEAD~ IN REGULAR ARRAY ON 9 IN. DIA. ALUMINUM SUBSTRATE USED AS FIELD STANDARD BY TEXAS INSTRUMENTS.

SUBJECT CODES
AEL AHD CJAG

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.2014	.0021	.0023	.1969	.201
	20.00	.1656	.0019	.0021	.1615	.166
	30.00	.1319	.0020	.0021	.1290	.132
	40.00	.1428	.0019	.0019	.1462	.146
	50.00	.1772	.0019	.0021	.1948	.188
	60.00	.2257	.0024	.0023	.2625	.246
	70.00	.2128	.0025	.0025	.2748	.246
	80.00	.1961	.0027	.0025	.2836	.242

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1800	.0022	.0020	.1755	.180
	20.00	.1520	.0017	.0018	.1504	.153
	30.00	.1310	.0018	.0018	.1361	.135
	40.00	.1354	.0021	.0022	.1476	.144
	50.00	.1689	.0018	.0020	.1919	.182
	60.00	.1833	.0019	.0020	.2246	.206
	70.00	.1572	.0019	.0019	.2107	.186
	80.00	.1274	.0018	.0017	.1912	.161

AC1272-001

TITLE
CHROME-PLATED GLASS BEADS, 3 MM DIA. BEADS IN REGULAR ARRAY ON 9 IN. DIA. ALUMINUM SUBSTRATE USED AS FIELD STANDARD BY TEXAS INSTRUMENTS.

SUBJECT CODES
AEL AHD CJAG

DATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16

PARAMETER INFORMATION
SOURCE= CKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)= 180.0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1305	.0017	.0020	.1307	.132
	10.00	.1576	.0049	.0056	.1707	.169
	20.00	.2139	.0143	.0153	.2579	.251
	30.00	.2370	.0252	.0270	.3391	.314
	40.00	.2663	.0267	.0291	.3782	.350
	50.00	.2600	.0252	.0282	.3781	.346
	60.00	.2211	.0256	.0286	.3580	.317
	70.00	.2760	.0167	.0189	.4859	.399
	80.00	.2868	.0076	.0082	.5693	.436

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1305	.0017	.0020	.1307	.132
	10.00	.1300	.0014	.0016	.1271	.130
	20.00	.1427	.0015	.0018	.1391	.143
	30.00					
	40.00	.0915	.0016	.0016	.0911	.093
	50.00	.0578	.0012	.0013	.0560	.058
	60.00	.0078	.0011	.0010	.0080	.009
	70.00	.0039	.0011	.0010	.0039	.005
	80.00	.0037	.0013	.0011	.0032	.005

AC1272-C01

TITLE
CHROME-PLATED GLASS BEADS, 3 MM DIA. BEADS IN REGULAR ARRAY ON 9 IN. DIA. ALUMINUM SUBSTRATE USED AS FIELD STANDARD BY TEXAS INSTRUMENTS.

SUBJECT CODES
AEL AHD CJAG

DATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24

PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)= 180.0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1723	.0021	.0025	.2092	.193
	10.00	.2000	.0056	.0057	.2682	.240
	20.00	.1837	.0088	.0091	.2731	.237
	30.00	.2052	.0222	.0253	.3389	.296
	40.00	.2670	.0372	.0422	.5231	.435
	50.00	.3580	.0491	.0561	.8129	.638
	60.00	.4040	.0571	.0667	1.081	.804
	70.00	.4245	.0479	.0579	1.418	.974
	80.00	.4144	.0319	.0440	2.073	1.282

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	21 RDF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1723	.0021	.0025	.2092	.193
	10.00	.1148	.0015	.0018	.1360	.127
	20.00	.0759	.0012	.0015	.0838	.081
	30.00	.0126	.0010	.0012	.0128	.014
	40.00	.0053	.0011	.0013	.0047	.006
	50.00	.0039	.0012	.0013	.0031	.005
	60.00					
	70.00	.0035	.0015	.0014	.0028	.005
	80.00	.0033	.0014	.0013	.0028	.004

AC1272-C01

TITLE
CHROME-PLATED GLASS BEADS, 3 MM DIA. BEADS IN REGULAR ARRAY ON 9 IN. DIA. ALUMINUM SUBSTRATE USED AS FIELD STANDARD BY TEXAS INSTRUMENTS.

SUBJECT CODES
AEL AHD CJAG

DATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 80.00 PHI(I)= 180.0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	25 RDF(LL) (1/SR)	26 RDF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1602	.0019	.0021	.2549	.210
	10.00	.1998	.0030	.0029	.3510	.278
	20.00	.1980	.0036	.0038	.3828	.294
	30.00	.1810	.0047	.0044	.4129	.302
	40.00	.1686	.0058	.0057	.4654	.323
	50.00	.2285	.0129	.0131	.8310	.543
	60.00	.3117	.0232	.0250	1.710	1.035
	70.00	.3338	.0269	.0269	2.275	1.331
	80.00	.5125	.0301	.0228	3.155	1.860

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	29 RDF(LL) (1/SR)	30 RDF(PL) (1/SR)	31 RDF(LP) (1/SR)	32 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1602	.0019	.0021	.2549	.210
	10.00	.0279	.0010	.0016	.0393	.035
	20.00	.0074	.0007	.0014	.0078	.009
	30.00	.0040	.0008	.0014	.0030	.005
	40.00	.0033	.0008	.0013	.0023	.004
	50.00	.0029	.0009	.0014	.0019	.004
	60.00	.0030	.0009	.0014	.0020	.004
	70.00	.0039	.0003	.0016	.0023	.004
	80.00					

AC1197-C01

TITLE
SANCBLASTED ST ALLMINUM (FINE).
SUBJECT CCDES
AELA CJADB
CATA SET NUMBERS
1, 2, 3, 4
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(O)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 10.CC PHI(I)= 18C.0 WAVELENGTH= .54C

DATA SET NUMBER		1	2	CCMPUTED
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.CC	.3188	.3197	.319
	1C.CO	.3524	.3541	.353
	2C.CO	.3221	.3288	.325
	3C.CO	.2842	.2913	.288
	4C.CO	.2476	.2558	.252
	5C.00	.2135	.2311	.222
	6C.CO	.1937	.2118	.203
	7C.CO	.1770	.1941	.186
	8C.00	.1394	.1729	.156

DATA SET NUMBER		3	4	CCMPUTED
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.00	.3188	.3197	.319
	1C.CO			
	2C.CO	.2336	.2382	.236
	3C.CO	.2C04	.2044	.202
	4C.CO	.1686	.1815	.175
	5C.00	.1569	.1682	.163
	6C.00	.1453	.1574	.151
	7C.00	.1298	.1386	.134

AC1197-CC2

TITLE
SANCBLASTED ST ALUMINUM (FINE).
SUBJECT CODES
AELA CJADB
CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 10.CC PHI(I)= 18C.0 WAVELENGTH= 1.08C

DATA SET NUMBER		1	2	3	4	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.3399	.0432	.0398	.3121	.368
	1C.CO	.3899	.C468	.0412	.3722	.425
	2C.0C	.335C	.0437	.0380	.3260	.371
	3C.00	.2767	.040C	.0345	.2730	.312
	4C.CO	.224C	.0372	.0332	.2286	.261
	5C.00	.1924	.C348	.0315	.201C	.230
	6C.CC	.1682	.C339	.0310	.1800	.207
	7C.CC	.15C7	.C307	.0274	.1642	.186
	8C.CO	.1392	.C267	.0238	.1525	.171

DATA SET NUMBER		5	6	7	8	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC	.3399	.0432	.0398	.3121	.368
	1C.0C					
	2C.CO	.2341	.C357	.0335	.2027	.253
	3C.CO	.1892	.C341	.0312	.1672	.211
	4C.CO	.1531	.0304	.0295	.1450	.179
	5C.00	.1342	.C263	.0275	.1248	.156
	6C.CO	.1228	.C265	.0263	.1158	.146
	7C.CO	.1157	.C224	.0253	.1050	.134
	8C.CO	.1C31	.0226	.0227	.0866	.118

AC1336-C01

TITLE
ALUMINUM ALCLAC PANEL USEC AS LABCRATCRY STANDARC BY
TEXAS INSTRUMENTS
SUBJECT CCDES
AELA CJAD
CATA SET NUMBERS
1, 2, 3, 4
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.06C

DATA SET NUMBER		1	2	CCMPUTED
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.CO			
	1C.00	.22[illegible]8	.2248	.227
	2C.00	.04[illegible]0	.C434	.044
	3C.00	.0184	.C178	.018
	4C.00	.0111	.C1C1	.011
	5C.C0	.CC86	.C067	.008
	6C.C0	.0077	.C049	.006
	7C.00	.C075	.C038	.006
	8C.C0	.CC79	.C031	.006

DATA SET NUMBER		3	4	CCMPUTED
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.C0			
	1C.00	.2263	.2217	.224
	2C.C0	.0434	.C427	.043
	3C.00	.0186	.0181	.018
	4C.00	.0116	.C1C9	.011
	5C.00	.0C88	.C07C	.008
	6C.CC	.0C80	.005C	.006
	7C.00	.0C80	.C036	.006
	8C.0C	.0C85	.C029	.006

AC1336-C01

TITLE
ALUMINUM ALCLAD PANEL USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS
SUBJECT CODES
AELA CJAD
DATA SET NUMBERS
5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER		5	6	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0071	.0042	.006
	10.00	.0097	.0062	.008
	20.00	.0148	.0104	.013
	30.00	.0278	.0220	.025
	40.00	.0762	.0683	.072
	50.00	.4055	.4151	.410
	60.00	134.61	149.51	142.060
	70.00	.8373	.8487	.843
	80.00	.2393	.1624	.201

DATA SET NUMBER		7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0071	.0042	.006
	10.00	.0058	.0032	.004
	20.00	.0050	.0025	.004
	30.00	.0047	.0023	.003
	40.00	.0040	.0021	.003
	50.00	.0050	.0022	.004
	60.00			
	70.00	.0074	.0029	.005
	80.00	.0145	.0062	.010

AC1296-CC1

TITLE
COPPER PLATED, SANDBLASTEC STAINLESS STEEL USEC AS LABCRATCRY STANCARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATEC)

SUBJECT CCDES
AELC AHA CJAG

CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER		1	2	3	4	COMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.0C					
	1C.CO	.1919	.C669	.0648	.1978	.261
	2C.CO	.2C26	.C645	.0649	.1968	.264
	3C.00	.2144	.0638	.0649	.2050	.274
	4C.CO	.22C3	.C597	.0623	.2065	.274
	5C.00	.2347	.C567	.0603	.2212	.286
	6C.CO	.245C	.C523	.0556	.2327	.293
	7C.00	.257C	.C457	.0492	.2402	.296
	8C.00	.2685	.C357	.0384	.2532	.298

CATA SET NUMBER		5	6	7	8	COMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.CO	.1914	.C641	.0643	.1894	.255
	2C.CO	.1925	.0635	.0625	.1915	.255
	3C.00	.1945	.0610	.0600	.1959	.256
	4C.00	.2069	.C58C	.0589	.2037	.264
	5C.00	.2172	.C556	.0557	.2139	.271
	6C.00	.2263	.0512	.0511	.2258	.277
	7C.00	.2355	.0453	.0457	.2382	.282
	8C.00	.2543	.C375	.0366	.2596	.294

AC1296-C01

TITLE
COPPER PLATED, SANDBLASTED STAINLESS STEEL USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATED)

SUBJECT CODES
AELC AHA CJAG

DATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16

PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 20.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1971	.0402	.0639	.1187	.210
	10.00	.2021	.0402	.0672	.1208	.215
	20.00	.2012	.0390	.0648	.1219	.213
	30.00	.2140	.0398	.0643	.1315	.225
	40.00	.2285	.0382	.0623	.1399	.234
	50.00	.2526	.0367	.0604	.1544	.252
	60.00	.2773	.0325	.0580	.1683	.268
	70.00	.3220	.0297	.0518	.1977	.301
	80.00	.3755	.0257	.0451	.2365	.341

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1971	.0402	.0639	.1187	.210
	10.00	.2007	.04[illegible]2	.0648	.1231	.214
	20.00					
	30.00	.2083	.0390	.0646	.1273	.220
	40.00	.2060	.0373	.0607	.1267	.215
	50.00	.2027	.0354	.0570	.1229	.209
	60.00	.2017	.0326	.0529	.1222	.205
	70.00	.2007	.0284	.0466	.1194	.198
	80.00	.1975	.0230	.0375	.1172	.188

AC1296-CC1

TITLE
COPPER PLATED, SANDBLASTED STAINLESS STEEL USEC AS LABCRATCRY STANCARC BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATED)
SUBJECT CODES
AELC AHA CJAG
CATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(0)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 30.CC PHI(I)=18C.CO WAVELENGTH= 1.060

DATA SET NUMBER		17	18	19	20	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RDF(PP)	RDF(OT)
= C	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1969	.C662	.0610	.2054	.265
	1C.CO	.2014	.C629	.0621	.2010	.264
	2C.00	.2076	.0623	.C634	.2094	.271
	3C.00	.2151	.0632	.0631	.2173	.279
	4C.00	.2332	.C621	.0621	.2370	.297
	5C.00	.2553	.C589	.0583	.2602	.316
	6C.00	.2934	.C561	.0564	.3030	.354
	7C.CC	.3423	.C508	.0512	.3641	.404
	8C.00	.4384	.C460	.0476	.4710	.501

DATA SET NUMBER		21	22	23	24	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/[illegible])	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.19[illegible]	.0662	.0610	.2054	.265
	1C.00	.2CC[illegible]	.0638	.0603	.2011	.263
	2C.CO	.2C[illegible]	.C644	.0620	.2107	.270
	3C.00					
	4C.00	.1975	.0628	.0599	.2059	.263
	5C.CO	.1912	.C572	.0545	.1949	.249
	6C.CO	.1828	.0526	.0498	.1855	.235
	7C.CO	.1736	.C457	.0434	.1771	.220
	8C.00	.17C9	.C377	.0335	.1709	.207

AC1296-C01

TITLE
COPPER PLATEC, SANDBLASTEC STAINLESS STEEL USEC AS LABCRATCRY STANCARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATEC)

SUBJECT CODES
AELC AHA CJAG

CATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 40.CO PHI(I)=18C.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	25 RCF(LL) (1/SR)	26 RCF(PL) (1/SR)	27 RCF(LP) (1/SR)	28 RCF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.CO	.2C38	.C6CC	.0582	.2034	.263
	1C.00	.2118	.C6CC	.0601	.2093	.271
	2C.00	.2156	.C599	.0590	.2140	.274
	3C.00	.2252	.C598	.0602	.2263	.286
	4C.00	.2397	.C588	.0589	.2426	.300
	5C.00	.2678	.C578	.0577	.2749	.329
	6C.CO	.3C29	.C546	.0535	.3194	.365
	7C.CO	.3718	.C494	.0521	.3990	.436
	8C.00	.4988	.C463	.0495	.5429	.569

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	29 RCF(LL) (1/SR)	30 RCF(PL) (1/SR)	31 RCF(LP) (1/SR)	32 RCF(PP) (1/SR)	CCMPUTED RDF(OT) (1/SR)
	C.00	.2C38	.C6CC	.0582	.2034	.263
	1C.CO	.2047	.C6C3	.0597	.2037	.264
	2C.00	.1995	.C595	.C578	.1982	.257
	3C.00	.1984	.C594	.0599	.2012	.259
	4C.00					
	5C.00	.1968	.C578	.C550	.1912	.250
	6C.00	.1855	.C521	.0523	.1762	.233
	7C.00	.1747	.C452	.0447	.1630	.214
	8C.00	.1644	.C365	.0357	.1527	.195

AC1296-001

TITLE
COPPER PLATED, SANDBLASTED STAINLESS STEEL USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATED)

SUBJECT CODES
AELD AHA CJAG

DATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 40

PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	33 RDF(LL) (1/SR)	34 RDF(PL) (1/SR)	35 RDF(LP) (1/SR)	36 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.2332	.0520	.0526	.2248	.281
	10.00	.2410	.0531	.0521	.2441	.295
	20.00	.2557	.0549	.0517	.2663	.314
	30.00	.2791	.0543	.0535	.2904	.339
	40.00	.2991	.0537	.0528	.3156	.361
	50.00	.3231	.0539	.0534	.3527	.392
	60.00	.3712	.0536	.0505	.4168	.446
	70.00	.4540	.0496	.0503	.5326	.543
	80.00	.6281	.0512	.0537	.7913	.762

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	37 RDF(LL) (1/SR)	38 RDF(PL) (1/SR)	39 RDF(LP) (1/SR)	40 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.2332	.0520	.0526	.2248	.281
	10.00	.2162	.0522	.0525	.2087	.265
	20.00	.1966	.0504	.0516	.1910	.245
	30.00	.1895	.0514	.0522	.1805	.237
	40.00	.1791	.0495	.0509	.1679	.224
	50.00	.1880	.0516	.0528	.1778	.235
	60.00					
	70.00	.1943	.0481	.0482	.1809	.236
	80.00	.1801	.0409	.0390	.1620	.211

AC1296-C01

TITLE
COPPER PLATED, SANDBLASTED STAINLESS STEEL USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATED)

SUBJECT CODES
AELC AHA CJAG

DATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48

PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 70.CO PHI(I)=18C.0C WAVELENGTH= 1.060

DATA SET NUMBER		41	42	43	44	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.22C4	.C426	.C445	.2157	.262
	1C.CO	.2580	.C469	.0474	.2532	.303
	2C.CO	.2885	.C491	.0497	.2880	.338
	3C.00	.3167	.C479	.0489	.3221	.368
	4C.CC	.3481	.C51C	.0483	.3621	.405
	5C.00	.378C	.C5C8	.0462	.4303	.453
	6C.CC	.4237	.051C	.0494	.5659	.545
	7C.CC	.5658	.C497	.0521	.9073	.787
	8C.CO	.82C4	.C583	.C648	1.251	1.097

DATA SET NUMBER		45	46	47	48	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.C	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.22C4	.C426	.0445	.2157	.262
	1C.CC	.1958	.0415	.C429	.1891	.235
	2C.00	.1775	.C416	.0435	.1714	.217
	3C.CO	.1612	.C4C6	.0421	.1539	.199
	4C.CO	.1567	.C4C6	.0429	.1481	.194
	5C.CO	.1515	.C392	.0402	.1421	.186
	6C.CO	.1767	.C436	.0460	.1664	.216
	7C.CC					
	8C.CO	.2192	.C449	.0456	.2228	.266

AC1332-001

TITLE
COPPER-PLATED, SANDBLASTED STAINLESS STEEL, 3 INCHES SQUARE.
SUBJECT CODES
AELD AHA CJAG
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.2122	.0797	.0820	.2061	.290
	20.00	.2128	.0774	.0783	.2071	.288
	30.00	.2212	.0737	.0751	.2150	.292
	40.00	.2271	.0688	.0[illegible]6	.2197	.293
	50.00	.2367	.0640	.0654	.2321	.299
	60.00	.2375	.0568	.0584	.2350	.294
	70.00	.2412	.0478	.0484	.2391	.288
	80.00	.2526	.0356	.0367	.2565	.291

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.2076	.0768	.0815	.1940	.280
	20.00	.2139	.0723	.0783	.1974	.281
	30.00	.2213	.0690	.0736	.2059	.285
	40.00	.2296	.0648	.0705	.2134	.289
	50.00	.2381	.0593	.0639	.2216	.291
	60.00	.2491	.0522	.0569	.2327	.295
	70.00	.2557	.0447	.0477	.2395	.294
	80.00	.2681	.0318	.0363	.2528	.295

AC1332-C01

TITLE
COPPER-PLATED, SANCBLASTEC STAINLESS STEEL, 3 INCHES SQUARE.
SUBJECT CODES
AELC AHA CJAG
DATA SET NUMBERS
9, 1C, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 20.CC PHI(I)=18C.CO WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.21C3	.C745	.0751	.2036	.282
	1C.CO	.2C31	.C747	.0755	.2022	.278
	2C.0C	.2C16	.0719	.0726	.1982	.272
	3C.00	.2122	.C7C3	.0713	.2097	.282
	4C.CO	.2256	.C654	.0676	.2263	.292
	5C.CO	.2465	.C58C	.0622	.2480	.307
	6C.CO	.2714	.C497	.0578	.2725	.326
	7C.00	.3C95	.C416	.0516	.3071	.355
	8C.CO	.3438	.C282	.0381	.3420	.376

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.0C	.21C3	.C745	.0751	.2036	.282
	1C.CC	.2237	.C757	.0762	.2189	.297
	2C.00					
	3C.CO	.2312	.0716	.0728	.2227	.299
	4C.CO	.2290	.C649	.0681	.2206	.291
	5C.00	.2193	.0581	.0614	.2116	.275
	6C.CO	.2175	.C519	.0537	.2087	.266
	7C.CC	.2C89	.C431	.0451	.2025	.250
	8C.00	.2130	.C309	.0337	.2015	.240

AC1332-C01

TITLE
COPPER-PLATED, SANDBLASTED STAINLESS STEEL, 3 INCHES SQUARE.
SUBJECT CODES
AELC AHA CJAG
DATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER		17	18	19	20	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.2212	.0724	.0750	.2152	.292
	10.00	.2062	.0718	.0726	.2062	.278
	20.00	.2054	.0711	.0712	.2067	.277
	30.00	.2067	.0694	.0683	.2101	.277
	40.00	.2206	.0667	.0655	.2253	.289
	50.00	.2435	.0639	.0613	.2517	.310
	60.00	.2844	.0575	.0597	.2876	.345
	70.00	.3302	.0503	.0527	.3367	.385
	80.00	.4115	.0432	.0460	.4195	.460

DATA SET NUMBER		21	22	23	24	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.2212	.0724	.0750	.2152	.292
	10.00	.2232	.0710	.0725	.2123	.289
	20.00	.2315	.0711	.0724	.2238	.299
	30.00					
	40.00	.2294	.0663	.0659	.2189	.290
	50.00	.2136	.0590	.0606	.2061	.270
	60.00	.2039	.0514	.0517	.1945	.251
	70.00	.1970	.0423	.0430	.1860	.234
	80.00	.1826	.0307	.0305	.1751	.209

AC1332-CC1

TITLE
COPPER-PLATED, SANDBLASTEC STAINLESS STEEL, 3 INCHES SQUARE.
SUBJECT CCDES
AELC AHA CJAG
CATA SET NUPBERS
25, 26, 27, 28, 29, 30, 31, 32
PARAPETER INFORMATICN
SOURCE= DKH GAPPA(C)= INSTRUPENTATICN= CLA
ACCURACY= FIVE PERCENT NUPBER CF RUNS AVERAGEC= 1
THETA(I)= 40.CC PHI(I)=18C.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	25 RDF(LL) (1/SR)	26 RCF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RCF(PP) (1/SR)	CCPPUTEC RCF(OT) (1/SR)
	C.CO	.2331	.C642	.C709	.2113	.290
	1C.OC	.224C	.C648	.0677	.2181	.287
	2C.CO	.22CO	.C64C	.0638	.2155	.282
	3C.00	.2195	.C632	.0638	.2154	.281
	4C.CO	.2288	.C593	.0615	.2263	.288
	5C.00	.2496	.C561	.0587	.2488	.307
	6C.CC	.286C	.C504	.C530	.2894	.339
	7C.CC	.3496	.C444	.C488	.3552	.399
	8C.CO	.4494	.C348	.0395	.4685	.496

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	29 RDF(LL) (1/SR)	30 RCF(PL) (1/SR)	31 RDF(LP) (1/SR)	32 RDF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.00	.2331	.C642	.0709	.2113	.290
	1C.CC	.2374	.C646	.0720	.2152	.295
	2C.00	.2276	.C644	.0691	.2114	.286
	3C.CC	.2317	.C629	.0688	.2125	.288
	4C.00					
	5C.00	.2126	.C565	.0585	.2027	.265
	6C.00	.2C23	.C498	.0521	.1893	.247
	7C.CO	.1856	.C394	.0420	.1736	.220
	8C.00	.1786	.C315	.0312	.1645	.203

AC1332-CC1

TITLE
COPPER-PLATEC, SANDBLASTED STAINLESS STEEL, 3 INCHES SQUARE.
SUBJECT CODES
AELC AHA CJAG
CATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 4C
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 60.CO PHI(I)=18C.CO WAVELENGTH= 1.060

DATA SET NUMBER		33	34	35	36	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC	.2375	.C57C	.0572	.2371	.294
	1C.CC	.256C	.C575	.0577	.2488	.310
	2C.CC	.264C	.C574	.0583	.2585	.319
	3C.0C	.2772	.C567	.0571	.2742	.333
	4C.0C	.2845	.C561	.0559	.2833	.340
	5C.00	.2958	.C531	.0537	.3019	.352
	6C.CC	.3294	.C493	.0502	.3430	.386
	7C.00	.3826	.C438	.0462	.4095	.441
	8C.C0	.5219	.C352	.0437	.5773	.589

DATA SET NUMBER		37	38	39	40	CCMPUTEC
PHI(R)	THETA(R)	ROF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
=18C.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC	.2375	.C57C	.0572	.2371	.294
	1C.0C	.2258	.C554	.0566	.2202	.279
	2C.C0	.2C97	.C523	.0545	.2028	.260
	3C.00	.2C72	.C523	.0544	.1978	.256
	4C.CC	.2CCC	.C494	.0515	.1882	.245
	5C.C0	.2C49	.C498	.C524	.1983	.253
	6C.00					
	7C.CC	.2134	.C425	.C437	.2050	.252
	8C.C0	.1833	.C314	.0323	.1764	.212

AC1332-C01

TITLE
COPPER-PLATED, SANDBLASTED STAINLESS STEEL, 3 INCHES SQUARE.
SUBJECT CODES
AELC AHA CJAG
DATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48
PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 70.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	41 RDF(LL) (1/SR)	42 RDF(PL) (1/SR)	43 RDF(LP) (1/SR)	44 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.2400	.0504	.0462	.2394	.288
	10.00	.2515	.0483	.0449	.2619	.303
	20.00	.2742	.0484	.0463	.2808	.325
	30.00	.2893	.0479	.0470	.2964	.340
	40.00	.3066	.0479	.0466	.3237	.362
	50.00	.3148	.0424	.0426	.3340	.367
	60.00	.3335	.0402	.0404	.3612	.388
	70.00	.3745	.0347	.0356	.4326	.439
	80.00	.4886	.0329	.0335	.5977	.576

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	45 RDF(LL) (1/SR)	46 RDF(PL) (1/SR)	47 RDF(LP) (1/SR)	48 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.2400	.0504	.0462	.2394	.288
	10.00	.2213	.0448	.0465	.2155	.264
	20.00	.2079	.0458	.0456	.2066	.253
	30.00	.1930	.0439	.0436	.1924	.236
	40.00	.1929	.0415	.0439	.1811	.230
	50.00	.1815	.0363	.0380	.1670	.211
	60.00	.2151	.0410	.0443	.2039	.252
	70.00					
	80.00	.2298	.0345	.0373	.2081	.255

(f)AEM 1

AC1187-C01

TITLE
BLACK PAINT (AF3621-73-0C0C-8730) THINNEC 1 TO 1 WITH AMYL ACETATE, 2 CCATS APPLIEC 5 MIN. APART, SPRAYEC CN 120 GAUCE STEEL.

SUBJECT CODES
AEM ECBBL

CATA SET NUMBERS
1, 2, 3, 4

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= C PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.00	.1176	.COCO	.C000	.1795	.149
	15.CO	.C369	.COCC	.C000	.0544	.046
	2C.00	.C142	.COCC	.0001	.0199	.017
	3C.CO	.CC34	.COC1	.0001	.0047	.004
	45.CO	.0C11	.C001	.0001	.C018	.002
	6C.00	.CCC7	.COC1	.C001	.C013	.001
	7C.00	.CC06	.COO1	.0001	.0013	.001
	8C.00	.CCC6	.COC2	.0001	.0013	.001

AC1187-C01

TITLE
BLACK PAINT (AF3621-73-0000-8730) THINNED 1 TO 1 WITH AMYL ACETATE, 2 COATS APPLIED 5 MIN. APART, SPRAYED ON 120 GAUGE STEEL.

SUBJECT CODES
AEM ECBBL

DATA SET NUMBERS
5, 6, 7, 8, 9, 10, 11, 12

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 45.00 PHI(I)= 180.0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0006	.0000	.0000	.0007	.001
	15.00	.0013	.0000	.0000	.0022	.002
	35.00	.0297	.0009	.0006	.1370	.084
	45.00	.4146	.0000	.0138	3.975	2.202
	55.00	.0299	.0000	.0031	.7923	.413
	65.00	.0010	.0000	.0005	.0916	.047
	80.00	.0010	.0000	.0000	.0198	.010

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0006	.0000	.0000	.0007	.001
	15.00	.0006	.0000	.0000	.0005	.001
	35.00	.0006	.0000	.0000	.0004	.001
	45.00					
	55.00	.0005	.0000	.0000	.0004	.000
	70.00	.0005	.0000	.0000	.0004	.000
	80.00	.0005	.0000	.0000	.0004	.000

AC1187-C01

TITLE
BLACK PAINT (AF3621-73-0000-8730) THINNED 1 TO 1 WITH AMYL ACETATE, 2 COATS APPLIED 5 MIN. APART, SPRAYED ON 120 GAUGE STEEL.
SUBJECT CODES
AEM ECBBL
DATA SET NUMBERS
13, 14, 15, 16, 17, 18, 19, 20
PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 70.00 PHI(I)= 180.0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0004	.0000	.0000	.0005	.000
	20.00	.0004	.0000	.0000	.0010	.001
	40.00	.0005	.0000	.0001	.0107	.006
	50.00		.0000		.0824	
	60.00	.0614	.0000	.0050	1.155	.611
	65.00	.8031	.0000	.0371	9.368	5.104
	70.00	8.340	.0000	.2453	64.830	36.708
	75.00	5.446	.0000	.1297	34.154	19.865
	80.00	1.256	.0000	.0193	5.953	3.614

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0004	.0000	.0000	.0005	.000
	20.00	.0004	.0000	.0000	.0004	.000
	40.00	.0005	.0000	.0000	.0004	.000
	60.00	.0004	.0000	.0001	.0005	.001
	70.00					
	80.00	.0006	.0000	.0001	.0009	.001

AC1337-CC1

TITLE
3 CCATS 3M BLACK VELVET PAINT COVERING 30 PERCENT CF ALUMINUM ALCLAD PANEL IN PCLKA-DCTTEC PATTERN USED AS LABCRATCRY STANCARC BY TEXAS INSTRUMENTS.

SUBJECT CODES
AEM ECBBL AELA CJAG

CATA SET NUMBERS
1, 2, 3, 4

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(O)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= C PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER		1	2	CCMPUTED
PHI(R)	THETA(R)	RDF(LT)	RCF(PT)	RCF(OT)
= C	(DEG)	(1/SR)	(1/SR)	(1/SR)
	C.CO			
	1C.00	.1873	.17C1	.179
	2C.CC	.C4C4	.C37C	.039
	3C.00	.0175	.0164	.017
	4C.00	.0106	.01C2	.010
	5C.00	.0C84	.0082	.008
	6C.00	.CC74	.C074	.007
	7C.00	.0C70	.C071	.007
	8C.CC	.0C97	.C085	.009

DATA SET NUMBER		3	4	CCMPUTED
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	C.CO			
	1C.00	.1884	.17C6	.179
	2C.00	.04C2	.0368	.039
	3C.00	.0172	.C165	.017
	4C.00	.0110	.01C7	.011
	5C.00	.0C84	.C085	.008
	6C.00	.0C75	.C076	.008
	7C.00	.0072	.C074	.007
	8C.00	.0073	.C086	.008

AC1337-C01

TITLE
3 CCATS 3M BLACK VELVET PAINT COVERING 30 PERCENT CF ALUMINUM ALCLAD PANEL IN PCLKA-DCTTED PATTERN USED AS LABCRATCRY STANDARD BY TEXAS INSTRUMENTS.

SUBJECT CCDES
AEM ECBBL AELA CJAC

CATA SET NUMBERS
5, 6, 7, 8

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 60.0C PHI(I)=18C.C0 WAVELENGTH= 1.060

DATA SET NUMBER		5	6	CCMPUTEC
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.C0	.CC73	.C071	.007
	1C.CC	.CC93	.C096	.009
	2C.CC	.0133	.C142	.014
	3C.C0	.C245	.C261	.025
	4C.C0	.C644	.C678	.066
	5C.00	.3C65	.3216	.314
	6C.0C	76.047	84.581	80.314
	7C.C0	.7653	.8295	.797
	8C.00	.2339	.2416	.238

DATA SET NUMBER		7	8	CCMPUTEC
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.0C	.CC73	.C071	.007
	1C.00	.CC65	.C06C	.006
	2C.C0	.CC61	.0052	.006
	3C.00	.0C60	.0049	.005
	4C.00	.0C53	.C041	.005
	5C.C0	.CC68	.C051	.006
	6C.00			
	7C.CC	.CC96	.0072	.008
	8C.00	.0177	.C161	.017

AC1338-C01

TITLE
3 COATS 3M BLACK VELVET PAINT COVERING 64.4 PERCENT OF ALUMINUM ALCLAD PANEL IN POLKA-DOTTED PATTERN USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS.

SUBJECT CODES
AEM   ECBBL   AELA   CJAG

DATA SET NUMBERS
1, 2, 3, 4

PARAMETER INFORMATION
SOURCE= DKH   GAMMA(O)=   INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
THETA(I)=   0   PHI(I)=   0   WAVELENGTH= 1.060

DATA SET NUMBER		1	2	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00			
	10.00	.1324	.1195	.126
	20.00	.0409	.0374	.039
	30.00	.0219	.0203	.021
	40.00	.0152	.0144	.015
	50.00	.0120	.0119	.012
	60.00	.0105	.0113	.011
	70.00	.0096	.0114	.011
	80.00	.0088	.0133	.011

DATA SET NUMBER		3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00			
	10.00	.1427	1266	.135
	20.00	.0409	.0368	.039
	30.00	.0220	.0206	.021
	40.00	.0149	.0147	.015
	50.00	.0116	.0123	.012
	60.00	.0105	.0114	.011
	70.00	.0099	.0120	.011
	80.00	.0093	.0139	.012

AC1338-C01

TITLE
3 CCATS 3M BLACK VELVET PAINT COVERING 64.4 PERCENT CF ALUMINUM ALCLAC PANEL IN PCLKA-DCTTEC PATTERN USED AS LABCRATCRY STANCARC BY TEXAS INSTRUMENTS.

SUBJECT CCDES
AEM ECBBL AELA CJAG

CATA SET NUMBERS
5, 6, 7, 8

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 60.CC PHI(I)=18C.CC WAVELENGTH= 1.06C

DATA SET NUMBER		5	6	CCMPUTEC
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.CC99	.C1C6	.010
	1C.CC	.C123	.C142	.013
	2C.CO	.C167	.C2C3	.019
	3C.00	.0279	.C347	.031
	4C.CC	.C631	.C76C	.070
	5C.CO	.2567	.289C	.273
	6C.CO	38.542	46.418	42.480
	7C.CC	.365C	.47C3	.418
	8C.CO	.1271	.2016	.164

DATA SET NUMBER		7	8	CCMPUTEC
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.CC99	.C1C6	.010
	1C.00	.CC9C	.C09C	.009
	2C.CO	.CC84	.C076	.008
	3C.CO	.CC84	.C072	.008
	4C.CO	.CC76	.C061	.007
	5C.00	.0C96	.C077	.009
	6C.OC			
	7C.CC	.0123	.C099	.011
	8C.CC	.0176	.0178	.018

AC1339-001

TITLE
3 COATS OF 3M BLACK VELVET PAINT ON ALUMINUM ALCLAD
PANEL SUBSTRATE USED AS LABORATORY STANDARD BY
TEXAS INSTRUMENTS.

SUBJECT CODES
AEM ECBBL CJAG

DATA SET NUMBERS
1, 2, 3, 4

PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER		1	2	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00			
	10.00	.0076	.0070	.007
	20.00	.0072	.0072	.007
	30.00	.0069	.0077	.007
	40.00	.0065	.0084	.007
	50.00	.0061	.0095	.008
	60.00	.0057	.0109	.008
	70.00	.0053	.0133	.009
	80.00	.0049	.0173	.011

DATA SET NUMBER		3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00			
	10.00	.0076	.0069	.007
	20.00	.0072	.0071	.007
	30.00	.0069	.0075	.007
	40.00	.0066	.0084	.008
	50.00	.0062	.0093	.008
	60.00	.0058	.0109	.008
	70.00	.0055	.0133	.009
	80.00	.0055	.0178	.012

AC1339-C01

TITLE
3 CCATS OF 3M BLACK VELVET PAINT CN ALUMINUM ALCLAD PANEL SUBSTRATE USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS.
SUBJECT CODES
AEM ECBBL CJAG
DATA SET NUMBERS
5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.CO PHI(I)=18C.CO WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	5 RDF(LT) (1/SR)	6 RDF(PT) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.0C56	.01C1	.008
	1C.00	.0C48	.C120	.008
	2C.00	.CC41	.C143	.009
	3C.00	.0C32	.C182	.011
	4C.00	.0C25	.C238	.013
	5C.00	.0C23	.C330	.018
	6C.00	.0C37	.C493	.026
	7C.CC	.C1C2	.C819	.046
	8C.00	.0322	.1519	.092

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	7 RDF(LT) (1/SR)	8 RDF(PT) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.0C56	.0101	.008
	1C.CO	.0062	.0093	.008
	2C.CO	.0C69	.C085	.008
	3C.CO	.0077	.C083	.008
	4C.CO	.0074	.C071	.007
	5C.00	.01CC	.C092	.010
	6C.CO			
	7C.00	.0128	.0119	.012
	8C.CO	.0C70	.0191	.013

AC129C-001

TITLE
3M WHITE VELVET PAINT (TWC CCATS) CN CNE CCAT ZINC CHRCMATE PRIMER CN ANOCIZED ALUMINUM SUBSTRATE (6 IN. SC.).
SUBJECT CODES
AEMA ECBBJ CJAG
CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER		1	2	3	4	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.00	.1559	.1330	.1297	.1519	.285
	2C.00	.1529	.1323	.1272	.1440	.278
	3C.00	.1516	.1317	.1314	.1471	.281
	4C.0C	.1482	.1288	.1309	.1433	.276
	5C.00	.1521	.1304	.1332	.1447	.280
	6C.00	.151C	.1293	.1329	.1450	.279
	7C.00	.1487	.1279	.1319	.1461	.277
	8C.00	.1443	.1226	.1246	.1438	.268

DATA SET NUMBER		5	6	7	8	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.CO	.158C	.1324	.1303	.1489	.285
	2C.00	.1551	.1346	.1333	.1483	.286
	3C.CO	.1515	.1326	.1329	.1471	.282
	4C.00	.15C2	.1347	.1308	.1504	.283
	5C.CO	.1457	.1334	.1287	.1496	.279
	6C.00	.1427	.1333	.1261	.1493	.276
	70.00	.1363	.1301	.1200	.1478	.267
	8C.00	.1283	.1237	.1107	.1454	.254

AC129C-C01

TITLE
3M WHITE VELVET PAINT (TWC CCATS) CN CNE CCAT ZINC CHRCMATE PRIMER CN ANCCIZED ALUMINUM SUBSTRATE (6 IN. SC.).
SUBJECT CCDES
AEMA ECBBJ CJAG
CATA SET NUMBERS
9, 1C, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 20.CC PHI(I)= 18C.C WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CC	.159C	.1286	.1349	.1416	.282
	1C.CO	.1568	.1259	.1376	.1422	.281
	2C.CC	.1513	.1264	.1341	.1405	.276
	3C.CO	.15C9	.1275	.1361	.1430	.279
	4C.00	.148C	.1311	.1348	.1464	.280
	5C.CO	.1458	.1345	.1331	.1496	.281
	6C.CO	.1414	.1331	.1285	.1540	.278
	7C.CO	.1394	.1351	.1262	.1638	.282
	8C.CO	.1354	.1325	.1194	.1699	.279

DATA SET NUMBER PHI(R) =18C.C	THETA(R) (CEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.0C	.159C	.1286	.1349	.1416	.282
	1C.C0	.1648	.1292	.1363	.1478	.289
	2C.CO					
	3C.00	.1676	.1253	.1387	.1457	.289
	4C.00	.1638	.1282	.139C	.1433	.287
	5C.00	.16C5	.1294	.1372	.1445	.286
	6C.00	.1584	.1338	.1357	.1493	.289
	7C.00	.1552	.1318	.1325	.1486	.284
	8C.00	.15C1	.1275	.1259	.1439	.274

AC129C-C01

TITLE
3M WHITE VELVET PAINT (TWC CCATS) CN CNE CCAT ZINC CHRCMATE PRIMER CN ANODIZED ALUMINUM SUBSTRATE (6 IN. SC.).

SUBJECT CCDES
AEMA ECBBJ CJAG

CATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 4C

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(O)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 60.00 PHI(I)= 18C.0 WAVELENGTH= 1.06C

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	33 RDF(LL) (1/SR)	34 RCF(PL) (1/SR)	35 RCF(LP) (1/SR)	36 RCF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.CC	.1556	.121C	.1400	.1389	.278
	1C.CO	.1558	.1205	.1428	.1410	.280
	2C.00	.1505	.1225	.14C4	.1474	.280
	3C.00	.149C	.1243	.14C4	.1530	.283
	40.CC	.1444	.1252	.1359	.1617	.284
	5C.C0	.1448	.1271	.1339	.1732	.289
	6C.C0	.1483	.1234	.1326	.1911	.298
	7C.CC	.1578	.1215	.1295	.2278	.318
	8C.00	.19C7	.1225	.1286	.3287	.385

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	37 RDF(LL) (1/SR)	38 RCF(PL) (1/SR)	39 RCF(LP) (1/SR)	40 RCF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.CO	.1556	.121C	.14C0	.1389	.278
	1C.00	.1613	.1269	.1431	.1451	.288
	2C.00	.1641	.1267	.1432	.1444	.289
	3C.00	.1748	.1311	.1460	.1491	.300
	4C.00	.1766	.1243	.1428	.1416	.293
	5C.00	.2C25	.1337	.1543	.1613	.326
	6C.00					
	7C.CC	.2314	.1493	.1675	.1814	.365
	8C.00	.2231	.1484	.1645	.1740	.355

AC129C-C01

TITLE
3M WHITE VELVET PAINT (TWC CCATS) CN CNE CCAT ZINC CHROMATE PRIMER CN ANODIZED ALUMINUM SUBSTRATE (6 IN. SC.).

SUBJECT CODES
AEMA ECBBJ CJAG

CATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 70.CC PHI(I)= 180.0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	41 RCF(LL) (1/SR)	42 RDF(PL) (1/SR)	43 RDF(LP) (1/SR)	44 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.00	.1458	.1174	.1322	.1384	.267
	1C.CO	.1360	.1165	.1255	.1405	.260
	2C.00	.1395	.1173	.1293	.1472	.267
	3C.00	.1368	.1165	.1262	.1532	.266
	4C.CO	.14C1	.1174	.1302	.1657	.277
	5C.00	.1431	.1151	.1298	.1822	.285
	6C.0C	.1536	.1138	.1292	.2159	.306
	7C.CO	.1877	.1171	.1296	.2990	.367
	8C.00	.3114	.1161	.1363	.5540	.559

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	45 RDF(LL) (1/SR)	46 RCF(PL) (1/SR)	47 RDF(LP) (1/SR)	48 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.0C	.1458	.1174	.1322	.1394	.267
	1C.00	.1464	.1164	.1305	.1353	.264
	2C.00	.1574	.1220	.1376	.1397	.278
	3C.00	.1631	.1220	.1388	.1403	.282
	4C.00	.17C9	.1295	.1416	.1504	.296
	5C.00	.1645	.1234	.1300	.1432	.281
	6C.00	.2103	.1457	.1539	.1796	.345
	7C.00					
	8C.00	.2668	.1745	.1779	.2226	.421

AC1292-C01

TITLE
3M WHITE VELVET PAINT (TWC CCATS) CN CNE CCAT ZINC CHRCMATE PRIMER CN ANODIZED ALUMINUM SUBSTRATE (11 IN. SQ.).
SUBJECT CODES
AEMA ECBBJ CJAG
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00					
	1C.00	.1730	.1508	.1432	.1698	.318
	2C.00	.1665	.1502	.1417	.1645	.311
	3C.00	.1639	.1528	.1433	.1694	.315
	4C.00	.1593	.1475	.14C0	.1653	.306
	5C.00	.1567	.1478	.1385	.1636	.303
	6C.00	.1526	.1457	.1353	.1629	.298
	7C.00	.1464	.1397	.1291	.1594	.287
	8C.00	.1351	.1269	.1160	.1488	.263

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00					
	1C.00	.1689	.1491	.1416	.1701	.315
	2C.00	.1643	.1489	.1418	.1664	.311
	3C.00	.1589	.1462	.1399	.1624	.304
	4C.00	.1592	.1467	.1409	.1629	.305
	5C.00	.1551	.1452	.1377	.1619	.300
	6C.00	.1504	.1427	.1340	.1601	.294
	7C.00	.1436	.1384	.1281	.1589	.285
	8C.00	.1357	.1298	.1176	.1530	.268

AC1292-CC2

TITLE
3M WHITE VELVET PAINT (TWO COATS) ON ONE COAT ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM SUBSTRATE (11 IN. SQ.).

SUBJECT CODES
AEMA ECBBJ CJAG

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.1798	.1507	.1503	.1698	.325
	20.00	.1748	.1502	.1479	.1645	.319
	30.00	.1742	.1528	.1524	.1694	.324
	40.00	.1685	.1474	.1487	.1653	.315
	50.00	.1673	.1477	.1463	.1636	.312
	60.00	.1620	.1457	.1442	.1629	.307
	70.00	.1571	.1397	.1373	.1594	.297
	80.00	.1473	.1269	.1278	.1488	.275

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.1805	.1414	.1510	.1613	.317
	20.00	.1770	.1423	.1517	.1590	.315
	30.00	.1739	.1408	.1513	.1564	.311
	40.00	.1708	.1423	.1511	.1581	.311
	50.00	.1675	.1420	.1483	.1583	.308
	60.00	.1626	.1405	.1439	.1577	.302
	70.00	.1538	.1373	.1358	.1577	.292
	80.00	.1375	.1298	.1184	.1530	.269

AC1292-C03

TITLE
3M WHITE VELVET PAINT (TWO COATS) ON ONE COAT ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM SUBSTRATE (11 IN. SQ.).

SUBJECT CODES
AEMA ECBBJ CJAG

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.9C INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= C PHI(I)= C WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00					
	1C.00	.1860	.1485	.1556	.1679	.329
	2C.00	.1770	.1476	.1492	.1626	.318
	3C.00	.1736	.15CC	.1529	.1663	.321
	4C.00	.1681	.1468	.1478	.1623	.313
	5C.00	.1656	.1467	.1458	.1623	.310
	6C.00	.1625	.1452	.1433	.1625	.307
	7C.00	.1559	.1425	.1382	.1607	.299
	8C.00	.1484	.1356	.1279	.1578	.285

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00					
	1C.00	.1822	.150C	.1525	.1693	.327
	2C.00	.1776	.1503	.1524	.1666	.323
	3C.00	.1732	.1482	.1517	.1635	.318
	4C.00	.1721	.1490	.1514	.1640	.318
	5C.00	.1684	.1459	.1497	.1614	.313
	6C.00	.1659	.1448	.1473	.1630	.310
	7C.00	.1577	.1383	.1410	.1563	.297
	8C.00	.1430	.1255	.1240	.1463	.269

AC1292-C03

TITLE
3M WHITE VELVET PAINT (TWC CCATS) CN CNE CCAT ZINC CHRCMATE PRIMER CN ANODIZED ALUMINUM SUBSTRATE (11 IN. SC.).
SUBJECT CODES
AEMA ECBBJ CJAG
CATA SET NUMBERS
9, 1C, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 60.CC PHI(I)= 18C.C WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	9 RDF(LL) (1/SR)	10 RCF(PL) (1/SR)	11 RCF(LP) (1/SR)	12 RCF(PP) (1/SR)	COMPUTEC RDF(OT) (1/SR)
	C.CO	.1603	.1412	.1451	.1602	.303
	1C.00	.1553	.1381	.1423	.1576	.297
	2C.CO	.1517	.1372	.1401	.1607	.295
	3C.CO	.1508	.1368	.1407	.1667	.298
	4C.00	.1478	.1349	.1384	.1708	.296
	5C.00	.1483	.1309	.1357	.1801	.298
	6C.00	.1492	.1285	.1331	.1975	.304
	7C.CO	.1566	.1258	.1295	.2364	.324
	8C.00	.1894	.1246	.1263	.3403	.390

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	13 RDF(LL) (1/SR)	14 RCF(PL) (1/SR)	15 RCF(LP) (1/SR)	16 RCF(PP) (1/SR)	COMPUTEC RDF(OT) (1/SR)
	C.CO	.1603	.1412	.1451	.1602	.303
	1C.00	.1655	.1425	.1478	.1598	.308
	2C.00	.1720	.1454	.1516	.1626	.316
	3C.00	.1830	.1500	.1546	.1696	.329
	4C.00	.1713	.1352	.1398	.1541	.300
	5C.00	.2152	.1596	.1655	.1878	.364
	6C.CO					
	7C.00	.2427	.1736	.1779	.2076	.401
	8C.00	.2280	.1679	.1731	.1922	.381

AC1027-003

TITLE
C.D. PAINT USED ON MAZ-200 7 TON TRUCK, 1 COAT APPLIED
ON 2 COATS OF ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM.
SAMPLE PREPARED AT U. OF M.
SUBJECT CODES
AEM8 ECBBI
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1127	.0050	.0042	.1149	.118
	20.00	.0384	.0043	.0039	.0411	.044
	30.00	.0170	.0041	.0039	.0189	.022
	40.00	.0107	.0041	.0039	.0119	.015
	50.00	.0086	.0043	.0038	.0094	.013
	60.00	.0077	.0042	.0036	.0084	.012
	70.00	.0078	.0045	.0037	.0080	.012
	80.00	.0072	.0041	.0035	.0081	.011

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1124	.0052	.0042	.1175	.120
	20.00	.0384	.0042	.0039	.0417	.044
	30.00	.0170	.0035	.0039	.0184	.021
	40.00	.0107	.0039	.0039	.0116	.015
	50.00	.0086	.0042	.0038	.0097	.013
	60.00	.0077	.0042	.0036	.0085	.012
	70.00	.0078	.0045	.0037	.0082	.012
	80.00	.0072	.0044	.0035	.0085	.012

AC1027-003

TITLE
C.D. PAINT USED CN MAZ-200 7 TCN TRUCK, 1 CCAT APPLIED CN 2 COATS OF ZINC CHRCMATE PRIMER ON ANODIZED ALUMINUM. SAMPLE PREPARED AT U. CF M.

SUBJECT CODES
AEMB ECBBI

CATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 20.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0421	.C041	.C041	.0448	.048
	1C.00	.1140	.C051	.0041	.1401	.132
	2C.00	.1936	.0054	.0047	.2750	.239
	3C.00	.11C9	.0053	.0042	.1946	.158
	4C.00	.C364	.COC5	.0040	.0778	.059
	5C.C0	.0149	.C049	.0041	.0352	.030
	6C.00	.0094	.C049	.0040	.0213	.020
	7C.00	.C077	.0049	.0036	.0177	.017
	8C.0C	.0C72	.0045	.0037	.0192	.017

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00	.0421	.C041	.0041	.0448	.048
	1C.00	.0184	.C046	.0041	.0197	.023
	2C.C0					
	3C.00	.01C4	.0047	.0039	.0105	.015
	4C.00	.CC91	.C046	.0040	.0091	.013
	5C.C0	.0C85	.C046	.0038	.0083	.013
	6C.00	.CC82	.C047	.0037	.0078	.012
	70.00	.0C80	.0046	.0034	.0074	.012
	80.00	.0C74	.C045	.0033	.0070	.011

AC1027-003

TITLE
C.D. PAINT USED ON MAZ-200 7 TON TRUCK, 1 COAT APPLIED ON 2 COATS OF ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM. SAMPLE PREPARED AT U. OF M.

SUBJECT CODES
AEMB ECBBI

DATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24

PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0110	.0039	.0042	.0119	.015
	10.00	.0169	.0041	.0044	.0233	.024
	20.00	.0367	.0046	.0043	.0719	.059
	30.00	.0956	.0062	.0049	.2748	.191
	40.00	.1400	.0079	.0050	.6384	.396
	50.00	.0651	.0076	.0051	.5414	.310
	60.00	.0174	.0063	.0049	.2621	.145
	70.00	.0083	.0059	.0045	.1378	.078
	80.00	.0100	.0057	.0042	.1217	.071

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	21 RDF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0110	.0039	.0042	.0119	.015
	10.00	.0096	.0041	.0043	.0093	.014
	20.00	.0092	.0041	.0041	.0085	.013
	30.00	.0099	.0044	.0044	.0089	.014
	40.00					
	50.00	.0105	.0048	.0045	.0089	.014
	60.00	.0100	.0048	.0042	.0080	.014
	70.00	.0094	.0048	.0040	.0073	.013
	80.00	.0086	.0046	.0034	.0067	.012

AC1C27-003

TITLE
C.D. PAINT USED CN MAZ-200 7 TCN TRUCK, 1 CCAT APPLIED
CN 2 COATS OF ZINC CHRCMATE PRIMER CN ANCDIZED ALUMINUM.
SAMPLE PREPARED AT L. CF M.

SUBJECT CODES
AEMB ECBBI

DATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 50.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	25 RDF(LL) (1/SR)	26 RDF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0081	.0037	.0038	.0096	.013
	10.00	.0097	.0038	.0039	.0147	.016
	20.00	.0144	.0040	.0041	.0340	.028
	30.00	.0269	.0047	.0057	.1173	.077
	40.00	.0513	.0068	.0047	.4726	.268
	50.00	.0474	.0094	.0052	1.189	.626
	60.00	.0108	.0091	.0051	1.141	.583
	70.00	.0117	.0086	.0045	.6697	.347
	80.00	.0322	.0083	.0042	.5032	.274

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	29 RDF(LL) (1/SR)	30 RDF(PL) (1/SR)	31 RDF(LP) (1/SR)	32 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0081	.0037	.0038	.0096	.013
	10.00	.0076	.0039	.0037	.0083	.012
	20.00	.0081	.0040	.0039	.0080	.012
	30.00	.0084	.0042	.0038	.0078	.012
	40.00	.0096	.0045	.0042	.0086	.013
	50.00					
	60.00	.0102	.0047	.0040	.0085	.014
	70.00	.0095	.0048	.0036	.0075	.013
	80.00	.0090	.0048	.0036	.0073	.012

AC1C27-C03

TITLE
C.D. PAINT USEC CN MAZ-2C0 7 TCN TRUCK, 1 CCAT APPLIEC
CN 2 COATS OF ZINC CHRCMATE PRIMER CN ANCCIZED ALUMINUM.
SAMPLE PREPAREC AT L. CF M.
SUBJECT CCDES
AEMB ECBBI
CATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 4C
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 60.CC PHI(I)=18C.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	33 RDF(LL) (1/SR)	34 RCF(PL) (1/SR)	35 RCF(LP) (1/SR)	36 RCF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.00	.0C79	.C038	.C042	.C091	.013
	1C.0C	.0C83	.C039	.0045	.0123	.015
	2C.0C	.CC95	.C041	.C045	.C222	.020
	3C.CC	.C118	.C043	.0048	.C599	.040
	4C.0C	.C147	.C048	.0050	.2300	.127
	5C.CC	.C1C7	.C078	.0057	1.020	.522
	6C.00	.C281	.C1CC	.C074	2.919	1.482
	7C.CC	.1683	.C1C2	.0069	3.324	1.755
	8C.CC	.3516	.C08C	.0061	2.578	1.472

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	37 RDF(LL) (1/SR)	38 RCF(PL) (1/SR)	39 RDF(LP) (1/SR)	40 RCF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.C0	.CC79	.C038	.0042	.C091	.013
	1C.0C	.CC77	.C038	.0042	.0075	.012
	2C.C0	.CC79	.C035	.0042	.0070	.011
	3C.C0	.0C85	.C038	.C043	.C071	.012
	4C.C0	.0C91	.C04C	.C043	.0075	.012
	5C.CC	.01C7	.C045	.0045	.C085	.014
	6C.C0					
	7C.00	.0119	.C048	.0045	.C088	.015
	8C.C0	.0111	.C047	.C041	.0092	.015

AC1C27-003

TITLE
C.D. PAINT USEC CN MAZ-2CO 7 TCN TRUCK, 1 COAT APPLIED
CN 2 CCATS OF ZINC CHRCMATE PRIMER ON ANCDIZED ALUMINUM.
SAMPLE PREPAREC AT L. CF M.
SUBJECT CCDES
AEMB ECBBI
CATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 70.CC PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER		41	42	43	44	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0C73	.C035	.0042	.0085	.012
	1C.00	.C071	.C034	.0042	.0106	.013
	2C.0C	.0C73	.C036	.0043	.0175	.016
	3C.00	.CC76	.C039	.0045	.0404	.028
	4C.CC	.CC73	.C047	.0045	.1371	.077
	5C.00	.0126	.0077	.0048	.6026	.314
	6C.00	.1489	.C193	.0060	2.864	1.519
	7C.CC	1.253	.0468	.0096	9.211	5.260
	8C.00	3.6C1	.0532	.0177	13.430	8.551

DATA SET NUMBER		45	46	47	48	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.C0	.CC73	.0035	.0042	.0085	.012
	1C.0C	.0072	.C033	.0040	.0066	.011
	2C.00	.CC76	.C034	.0042	.0068	.011
	3C.00	.CC80	.C035	.0041	.0061	.011
	4C.CC	.0C90	.0037	.0043	.0069	.012
	5C.00	.01C1	.0040	.0045	.0074	.013
	6C.00	.C121	.C045	.0046	.0093	.015
	7C.00					
	8C.00	.C159	.0058	.0050	.0161	.021

AC1044-003

TITLE
O.D. PAINT USED ON MAZ-200 7 TON TRUCK, 2 COATS APPLIED
ON 2 COATS OF ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM.
SAMPLE PREPARED AT U. OF M.

SUBJECT CODES
AEMB   ECBBI

DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATION
SOURCE= DKI   GAMMA(C)=.90   INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0   PHI(I)= 0   WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1156	.0044	.0042	.1159	.120
	20.00	.0405	.0040	.0039	.0417	.045
	30.00	.0186	.0039	.0038	.0196	.023
	40.00	.0113	.0039	.0039	.0123	.016
	50.00	.0089	.0043	.0036	.0099	.013
	60.00	.0078	.0042	.0037	.0090	.012
	70.00	.0072	.0044	.0034	.0085	.012
	80.00	.0071	.0043	.0035	.0090	.012

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1139	.0042	.0041	.1151	.119
	20.00	.0442	.0041	.0039	.0476	.050
	30.00	.0185	.0042	.0039	.0210	.024
	40.00	.0113	.0043	.0038	.0129	.016
	50.00	.0090	.0043	.0037	.0102	.014
	60.00	.0081	.0045	.0037	.0092	.013
	70.00	.0074	.0045	.0037	.0085	.012
	80.00	.0071	.0046	.0032	.0090	.012

AC1C44-CO3

TITLE
C.D. PAINT USED CN MAZ-2CO 7 TCN TRUCK, 2 CCATS APPLIEC CN 2 COATS OF ZINC CHRCMATE PRIMER ON ANCDIZED ALUMINUM. SAMPLE PREPARED AT U. CF M.

SUBJECT CODES
AEMB ECB8I

DATA SET NUMBERS
9, 1C, 11, 12, 13, 14, 15, 16

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 20.0C PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.C447	.C04C	.0039	.0483	.050
	1C.00	.1C91	.C041	.0042	.1276	.122
	2C.CO	.1565	.C043	.0041	.2076	.186
	3C.CO	.C987	.C043	.0040	.1559	.131
	4C.00	.0366	.C044	.0041	.0732	.059
	5C.CO	.0155	.C046	.0041	.0354	.030
	6C.00	.CC96	.C044	.0039	.0215	.020
	7C.CO	.CC77	.C046	.0037	.0179	.017
	8C.CO	.0070	.C044	.0034	.0192	.017

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.0447	.C040	.0039	.0483	.050
	1C.CO	.0190	.C044	.0042	.0186	.023
	2C.CO					
	3C.00	.01C5	.C041	.0041	.0098	.014
	4C.00	.0C92	.C042	.0040	.0086	.013
	5C.00	.0083	.0043	.0037	.0079	.012
	6C.CO	.CC82	.C044	.0037	.0074	.012
	7C.CO	.0079	.C044	.0033	.0070	.011
	8C.00	.0077	.C039	.0033	.0063	.011

AC1C44-C03

TITLE
C.D. PAINT USED CN MAZ-2CO 7 TCN TRUCK, 2 COATS APPLIEC CN 2 COATS OF ZINC CHRCMATE PRIMER ON ANCDIZED ALUMINUM. SAMPLE PREPARED AT U. CF M.

SUBJECT CODES
AEMB ECBBI

CATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 40.CC PHI(I)=180.CO WAVELENGTH= .633

DATA SET NUMBER		17	18	19	20	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.C111	.0039	.0041	.0123	.016
	1C.0C	.C169	.C041	.0040	.0249	.025
	2C.00	.0370	.C041	.0042	.0771	.061
	3C.00	.0857	.C045	.0045	.2630	.179
	4C.00	.1C84	.0049	.0048	.5032	.311
	50.00	.C531	.C049	.0005	.4465	.252
	6C.00	.0159	.C049	.0046	.2407	.133
	7C.00	.0079	.C049	.0044	.1298	.074
	80.00	.0C91	.0049	.0044	.1170	.068

DATA SET NUMBER		21	22	23	24	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0111	.C039	.C041	.0123	.016
	1C.00	.0C95	.C039	.0041	.0090	.013
	2C.00	.0C92	.C04C	.0040	.0084	.013
	3C.00	.0101	.C043	.0044	.0091	.014
	4C.00					
	5C.00	.0C99	.C044	.C042	.0083	.013
	60.00	.0C94	.C047	.0038	.0077	.013
	70.00	.0C87	.C046	.0035	.0071	.012
	8C.00	.0C84	.0041	.0033	.0065	.011

AC1C44-C03

TITLE
C.D. PAINT USEC CN MAZ-2CO 7 TCN TRUCK, 2 CCATS APPLIEC CN 2 COATS OF ZINC CHRCMATE PRIMER CN ANCDIZED ALUMINUM. SAMPLE PREPARED AT U. CF M.

SUBJECT CODES
AEMB · ECBBI

CATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(O)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 50.CO PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		25	26	27	28	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0C85	.C04C	.0041	.0100	.013
	1C.00	.01C2	.C039	.0042	.0150	.017
	2C.C0	.C135	.C041	.0044	.0356	.029
	3C.00	.C301	.0045	.0046	.1286	.084
	4C.00	.0536	.C05C	.0049	.4691	.266
	5C.00	.0442	.C06C	.0053	1.005	.530
	6C.00	.0118	.0073	.0054	.9560	.490
	7C.CC	.C123	.C067	.0050	.6029	.313
	8C.00	.C333	.C056	.0041	.4739	.258

DATA SET NUMBER		29	30	31	32	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.0C	.0C85	.C04C	.0041	.01C0	.013
	1C.0C	.0085	.C038	.0041	.0082	.012
	20.00	.0C87	.C038	.0043	.0078	.012
	30.C0	.0C89	.0039	.0042	.0077	.012
	40.00	.01C3	.C044	.0045	.C086	.014
	5C.00					
	6C.00	.0106	.C047	.0042	.0084	.014
	7C.00	.0C96	.0045	.0038	.C073	.013
	8C.00	.0C90	.0047	.0034	.C066	.012

A01C44-003

TITLE
C.D. PAINT USED ON MAZ-200 7 TON TRUCK, 2 COATS APPLIED ON 2 COATS OF ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM. SAMPLE PREPARED AT U. OF M.

SUBJECT CODES
AEMB ECBBI

DATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 40

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		33	34	35	36	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0078	.0038	.0041	.0088	.012
	10.00	.0083	.0038	.0043	.0119	.014
	20.00	.0095	.0040	.0045	.0214	.020
	30.00	.0118	.0042	.0046	.0593	.040
	40.00	.0154	.0046	.0049	.2503	.138
	50.00	.0112	.0060	.0058	1.029	.526
	60.00	.0244	.0084	.0067	2.526	1.283
	70.00	.1501	.0100	.0071	2.913	1.540
	80.00	.3329	.0085	.0060	2.412	1.380

DATA SET NUMBER		37	38	39	40	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0078	.0038	.0041	.0088	.012
	10.00	.0078	.0037	.0041	.0079	.012
	20.00	.0082	.0036	.0043	.0072	.012
	30.00	.0088	.0037	.0043	.0071	.012
	40.00	.0093	.0039	.0044	.0075	.013
	50.00	.0111	.0044	.0047	.0085	.014
	60.00					
	70.00	.0116	.0047	.0044	.0086	.015
	80.00	.0113	.0051	.0044	.0087	.015

AC1C44-CO3

TITLE
C.D. PAINT USED CN MAZ-200 7 TCN TRUCK, 2 CCATS APPLIEC CN 2 COATS OF ZINC CHRCMATE PRIMER CN ANCDIZED ALUMINUM. SAMPLE PREPAREC AT U. CF M.
SUBJECT CCDES
AEMB ECBBI
CATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 70.CC PHI(I)=18C.00 WAVELENGTH= .633

DATA SET NUMBER		41	42	43	44	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.C071	.C036	.0042	.0084	.012
	1C.00	.C073	.C035	.0042	.0107	.013
	2C.00	.C075	.C037	.0044	.0168	.016
	3C.00	.0078	.C037	.0046	.0374	.027
	4C.00	.0C78	.C042	.0049	.1309	.074
	5C.00	.0129	.C053	.0053	.6307	.327
	6C.00	.1618	.0098	.0073	3.233	1.706
	7C.00	1.198	.C182	.0110	9.175	5.201
	8C.00	3.475	.C249	.0147	12.929	8.222

DATA SET NUMBER		45	46	47	48	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.C0	.C071	.C036	.0042	.C084	.012
	1C.00	.0C72	.C034	.0041	.0072	.011
	2C.00	.0076	.C035	.0041	.0068	.011
	30.00	.0083	.C036	.0043	.0066	.011
	4C.00	.CC91	.C036	.0044	.0068	.012
	5C.00	.0C98	.C039	.0045	.0072	.013
	6C.00	.0120	.C047	.0050	.0087	.015
	7C.00					
	8C.00	.0124	.C057	.0037	.0144	.018

AC1C47-C03

TITLE
2 CCATS 529A C.C. PAINT CN 2 CCATS ZINC CHRCMATE, WET CECKED CN ANODIZED ALLMINUM, SAMPLE PREPAREC AT U. CF M.

SUBJECT CCDES
AEMB ECBBI

CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= C PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.0C	.0447	.C025	.0024	.0480	.049
	2C.00	.0312	.0023	.0022	.0362	.036
	3C.00	.0216	.0021	.0022	.0272	.027
	4C.CO	.0142	.0025	.0021	.0201	.019
	5C.00	.0106	.C025	.0023	.0155	.015
	60.00	.0081	.0026	.C021	.0131	.013
	7C.00	.0067	.0029	.0020	.0122	.012
	8C.00	.0065	.C026	.0026	.0132	.012

DATA SET NUMBER		5	6	7	8	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(CT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	1C.CC	.0445	.C025	.0024	.0473	.048
	2C.0C	.0337	.C024	.0022	.0373	.038
	3C.00	.0232	.C024	.0024	.C275	.028
	4C.CO	.C156	.CC25	.0022	.C202	.020
	5C.CO	.011C	.CC25	.0023	.0152	.015
	60.0C	.0088	.0026	.0023	.C129	.013
	7C.00	.CC72	.C027	.0026	.0119	.012
	8C.CO	.CC65	.CC26	.0016	.C137	.012

AC1C47-0C3

TITLE
2 CCATS 529A C.C. PAINT CN 2 CCATS ZINC CHRCMATE, WET CECKED CN ANODIZED ALUMINUM, SAMPLE PREPAREC AT U. CF M.
SUBJECT CODES
AEMB ECBBI
CATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
SOURCE= OKI GAMMA(O)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 20.CC PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.C321	.C023	.0022	.0356	.036
	1C.0C	.04C3	.C026	.0021	.0548	.050
	2C.00	.0422	.0023	.0021	.0654	.056
	3C.00	.0392	.C024	.0022	.0693	.057
	4C.C0	.0275	.C024	.0023	.0626	.047
	5C.00	.0181	.0027	.0023	.0532	.038
	6C.C0	.0115	.C027	.0024	.0445	.031
	7C.C0	.C080	.C03C	.0023	.0420	.028
	8C.C0	.C057	.0025	.0024	.0469	.029

DATA SET NUMBER		13	14	15	16	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.C0	.C321	.CC23	.0022	.0356	.036
	1C.CC	.C242	.C025	.0023	.0240	.026
	2C.C0					
	3C.CC	.C127	.0027	.0025	.0126	.015
	4C.00	.CC96	.C026	.0024	.0098	.012
	5C.00	.0C82	.0026	.0024	.0081	.011
	6C.00	.0072	.0024	.0026	.0073	.010
	7C.00	.CC67	.C025	.0020	.0068	.009
	8C.00	.CC65	.C023	.0024	.0070	.009

AC1C47-C03

TITLE
2 CCATS 529A C.C. PAINT CN 2 CCATS ZINC CHRCMATE, WET CECKED
CN ANCDIZED ALUMINUM, SAMPLE PREPAREC AT U. CF M.
SUBJECT CCDES
AEMB ECBBI
CATA SET NUMBERS
17, 18, 19, 2C, 21, 22, 23, 24
PARAMETER INFORMATICN
SOURCE= CKI GAMMA(O)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 40.CC PHI(I)=18C.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.CO	.0140	.CC23	.0020	.0188	.019
	1C.CO	.0202	.C024	.0022	.0328	.029
	2C.00	.C267	.C025	.0023	.0592	.045
	3C.CO	.C320	.C028	.0025	.1043	.071
	4C.CO	.031C	.C03C	.0025	.1585	.098
	5C.00	.0225	.C031	.0026	.2078	.118
	6C.0C	.0114	.0031	.C026	.2249	.121
	7C.00	.CC58	.C034	.0028	.2384	.125
	8C.CO	.0C87	.C032	.0031	.2734	.144

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	21 RDF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	CCMPUTED RDF(OT) (1/SR)
	C.CC	.0140	.CC23	.0020	.0188	.019
	1C.C0	.0112	.C024	.0022	.0126	.014
	2C.00	.CC93	.C024	.0022	.0096	.012
	3C.CC	.0C92	.CC27	.0024	.0086	.011
	4C.CO					
	5C.00	.CC85	.0028	.0026	.C077	.011
	6C.00	.CC81	.C026	.0025	.C067	.010
	7C.CC	.0075	.CC29	.C025	.0064	.010
	8C.CO	.CC70	.0031	.0018	.0061	.009

AC1047-003

TITLE
2 COATS 529A C.C. PAINT ON 2 COATS ZINC CHROMATE, WET DECKED ON ANODIZED ALUMINUM, SAMPLE PREPARED AT U. OF M.

SUBJECT CODES
AEMB ECBBI

DATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 50.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	25 RDF(LL) (1/SR)	26 RDF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0105	.0024	.0021	.0146	.015
	10.00	.0131	.0024	.0022	.0253	.022
	20.00	.0177	.0026	.0024	.0497	.036
	30.00	.0202	.0027	.0024	.0991	.062
	40.00	.0216	.0032	.0028	.1960	.112
	50.00	.0141	.0034	.0029	.3319	.176
	60.00	.0061	.0037	.0030	.4854	.249
	70.00	.0111	.0043	.0034	.6132	.316
	80.00	.0422	.0040	.0032	.7442	.397

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	29 RDF(LL) (1/SR)	30 RDF(PL) (1/SR)	31 RDF(LP) (1/SR)	32 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0105	.0024	.0021	.0146	.015
	10.00	.0085	.0021	.0022	.0098	.011
	20.00	.0078	.0023	.0023	.0081	.010
	30.00	.0077	.0025	.0024	.0074	.010
	40.00	.0086	.0027	.0026	.0077	.011
	50.00					
	60.00	.0090	.0030	.0026	.0076	.011
	70.00	.0084	.0028	.0027	.0069	.010
	80.00	.0080	.0031	.0024	.0072	.010

AC1C47-CC3

TITLE
2 CCATS 529A C.C. PAINT CN 2 CCATS ZINC CHRCMATE, WET CECKED
CN ANCDIZED ALLMINUM, SAMPLE PREPAREC AT U. CF M.
SUBJECT CCDES
AEMB ECBBI
CATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 4C
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(C)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 60.CC PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER		33	34	35	36	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.0079	.C023	.0022	.0124	.012
	1C.00	.CC98	.0023	.C024	.C214	.018
	2C.00	.C111	.0026	.0025	.0431	.030
	3C.00	.0124	.C028	.C027	.0931	.056
	4C.00	.C1C3	.003C	.0030	.2038	.110
	5C.0C	.CC64	.0036	.0031	.4579	.236
	60.CC	.0140	.C044	.C034	.9055	.464
	7C.00	.0747	.C048	.0038	1.484	.784
	8C.00	.2572	.0056	.0043	2.102	1.185

DATA SET NUMBER		37	38	39	40	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=18C.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0079	.C023	.C022	.C124	.012
	1C.00	.0C74	.C023	.0023	.0087	.010
	2C.C0	.CC69	.C023	.C023	.0072	.009
	3C.00	.C07C	.C024	.0024	.0066	.009
	4C.00	.0076	.0025	.0025	.C065	.010
	5C.00	.CC9C	.CC3C	.0029	.0080	.011
	6C.00					
	7C.00	.C1C1	.C034	.C032	.0085	.013
	8C.00	.0103	.C035	.0033	.0085	.013

AC1C47-CO3

TITLE
2 CCATS 529A C.C. PAINT CN 2 CCATS ZINC CHRCMATE, WET CECKED CN ANODIZED ALUMINUM, SAMPLE PREPARED AT U. CF M.
SUBJECT CODES
AEMB ECBBI
CATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(O)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 70.CC PHI(I)=18C.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	41 RDF(LL) (1/SR)	42 RDF(PL) (1/SR)	43 RDF(LP) (1/SR)	44 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.CC67	.C022	.0023	.0118	.012
	1C.00	.CC73	.C024	.0024	.0199	.016
	2C.00	.0075	.C026	.0025	.0394	.026
	3C.00	.0066	.C025	.0025	.0857	.049
	4C.00	.CC52	.C031	.0029	.2163	.114
	5C.00	.0117	.C036	.0031	.5459	.282
	6C.00	.0713	.C048	.0036	1.364	.722
	7C.00	.4014	.C071	.0054	3.265	1.839
	8C.00	1.414	.C095	.0072	6.211	3.821

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	45 RDF(LL) (1/SR)	46 RDF(PL) (1/SR)	47 RDF(LP) (1/SR)	48 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.CC67	.C022	.0023	.0118	.012
	1C.0C	.0C64	.C022	.0022	.0084	.010
	2C.00	.CC64	.C022	.0024	.0068	.009
	3C.00	.0C66	.C023	.0025	.0061	.009
	4C.00	.0073	.C024	.0025	.0062	.009
	5C.00	.0C82	.C03C	.0029	.0070	.011
	6C.00	.01C0	.C032	.0030	.0090	.013
	7C.00					
	8C.00	.0148	.C046	.0038	.0137	.018

AC1509-C01

TITLE
C.D. PAINTED STEEL PLATE, 7-3/4 IN. SQ., TAKEN FROM A L.S.
18 TCN M4A HIGH SPEED TRACTCR.

SUBJECT CCDES
AEMB ECBBI

CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8

PARAMETER INFORMATICN
SOURCE= DKH GAMMA(0)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= C PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
= C	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC					
	1C.0C	.C25	.0C8	.008	.025	.033
	2C.C0	.C22	.0C8	.007	.024	.031
	3C.CC	.C21	.0C8	.008	.024	.031
	4C.00	.C20	.0C9	.008	.024	.031
	5C.C0	.C19	.0C9	.009	.026	.032
	6C.0C	.C18	.01C	.010	.028	.033
	7C.00	.C18	.011	.011	.030	.035
	8C.C0	.C19	.012	.012	.033	.038

DATA SET NUMBER		5	6	7	8	COMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00					
	1C.CC	.C26	.0C8	.008	.026	.034
	2C.C0	.C24	.0C8	.008	.025	.033
	3C.00	.C22	.008	.008	.025	.032
	4C.0C	.C21	.0C9	.009	.025	.032
	5C.00	.C19	.0C9	.009	.026	.032
	6C.0C	.C19	.01C	.010	.029	.034
	7C.00	.C19	.011	.011	.031	.036
	8C.C0	.C19	.012	.012	.033	.038

AC1509-C01

TITLE
C.D. PAINTED STEEL PLATE, 7-3/4 IN. SQ., TAKEN FROM A U.S. 18 TCN M4A HIGH SPEED TRACTCR.
SUBJECT CCDES
AEMB ECBBI
CATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 45.CC PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	5.00	.019	.009	.009	.026	.032
	15.00	.019	.010	.009	.030	.034
	25.00	.018	.010	.010	.036	.037
	35.00	.018	.011	.011	.044	.042
	45.00	.019	.013	.012	.055	.050
	55.00	.022	.013	.013	.068	.058
	65.00	.027	.015	.015	.084	.071
	75.00	.038	.016	.017	.108	.090
	85.00	.058	.019	.019	.141	.119

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	5.00	.020	.009	.008	.024	.031
	15.00	.022	.009	.008	.023	.031
	25.00	.023	.009	.008	.024	.032
	35.00	.027	.010	.009	.026	.036
	45.00					
	55.00	.030	.011	.011	.029	.041
	65.00	.029	.011	.011	.029	.040
	75.00	.030	.013	.013	.030	.043
	85.00	.029	.014	.014	.029	.043

(f)BGCM 1

AC1327-001

TITLE
MERICN BLUE GRASS SCD FRESHLY CBTAINED, 3 IN. GRASS BLADES,
SANDY LCAM SOIL NOT VISIBLE
SUBJECT CODES
BGCM
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.0068	.0047	.0038	.0084	.012
	20.00	.0056	.0052	.0035	.0089	.012
	30.00	.0053	.0052	.0035	.0090	.011
	40.00	.0050	.0050	.0035	.0085	.011
	50.00	.0046	.0051	.0034	.0090	.011
	60.00	.0042	.0047	.0031	.0084	.010
	70.00	.0039	.0042	.0031	.0071	.009
	80.00	.0055	.0057	.0043	.0097	.013

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.0071	.0043	.0042	.0075	.012
	20.00	.0061	.0037	.0037	.0065	.010
	30.00	.0051	.0030	.0034	.0052	.008
	40.00	.0048	.0023	.0033	.0039	.007
	50.00	.0051	.0024	.0035	.0043	.008
	60.00	.0045	.0027	.0033	.0043	.007
	70.00	.0047	.0025	.0036	.0042	.007
	80.00	.0050	.0028	.0039	.0051	.008

AC1327-C01

TITLE
 MERICN BLUE GRASS SCD FRESHLY CBTAINEC, 3 IN. GRASS BLADES,
 SANCY LCAM SCIL NCT VISIBLE
SUBJECT CCDES
 BGCM
CATA SET NUMBERS
 9, 1C, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
 SOURCE= DKI GAMMA(O)=.9C INSTRUMENTATICN= CLA
 ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
 THETA(I)= 20.CO PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.00	.CC57	.C048	.0035	.0083	.011
	1C.00	.0041	.C045	.0028	.0075	.009
	2C.00	.CC32	.C041	.0024	.0068	.008
	3C.00	.0C28	.C039	.0022	.0065	.008
	4C.00	.0C25	.C036	.0019	.0059	.007
	5C.C0	.CC38	.0025	.C031	.C036	.006
	6C.00	.CC39	.C024	.0030	.0035	.006
	7C.00	.0C36	.C024	.0027	.0036	.006
	8C.0C	.0048	.C027	.0034	.0040	.007

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.C0	.0C57	.C048	.0035	.0083	.011
	1C.C0	.0072	.C05C	.0039	.0092	.013
	2C.C0					
	3C.C0	.0C92	.C057	.0050	.0107	.015
	4C.C0	.01C2	.C05C	.0058	.0092	.015
	5C.00	.0113	.C055	.0064	.C104	.017
	6C.CC	.C126	.C067	.0071	.0132	.020
	7C.0C	.0135	.0078	.0080	.0164	.023
	8C.00	.0177	.C123	.0109	.0282	.035

AC1327-C01

TITLE
MERICN BLUE GRASS SCD FRESHLY CBTAINED, 3 IN. GRASS BLADES, SANDY LCAM SOIL NCT VISIBLE
SUBJECT CCDES
BGCM
CATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 40.CO PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RCF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.00	.0046	.0032	.0033	.0055	.008
	1C.00	.0036	.C026	.0027	.0042	.007
	2C.CO	.0C25	.C021	.0021	.0033	.005
	3C.00	.0C19	.0025	.0016	.0035	.005
	4C.00	.0C17	.C022	.0014	.0031	.004
	5C.00	.0C17	.C023	.0014	.C031	.004
	6C.00	.0C21	.C026	.0016	.0039	.005
	7C.CC	.0C23	.C028	.0017	.0044	.006
	8C.00	.0C29	.0029	.0020	.0045	.006

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	21 RCF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	C.00	.0046	.C032	.0033	.0055	.008
	1C.CO	.0C58	.C036	.C036	.0066	.010
	2C.CO	.0C74	.C041	.0044	.0073	.012
	3C.CO	.01C1	.C049	.0051	.0094	.015
	4C.00					
	5C.CO	.C141	.0082	.0068	.0176	.023
	6C.00	.0139	.0075	.0068	.0158	.022
	7C.00	.013C	.0083	.0067	.0179	.023
	8C.00	.0126	.0094	.0069	.0200	.024

AC1327-CO1

TITLE
MERICN BLUE GRASS SCD FRESHLY CBTAINEC, 3 IN. GRASS BLACES, SANDY LCAM SOIL NCT VISIBLE
SUBJECT CCDES
BGCM
CATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(G)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 50.CO PHI(I)=18C.CC WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (CEG)	25 RCF(LL) (1/SR)	26 RCF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RDF(PP) (1/SR)	CCMPUTEC RCF(OT) (1/SR)
	C.CC	.CC36	.C025	.0027	.C042	.0C6
	1C.CC	.CC29	.CC2C	.0022	.0032	.C05
	2C.CO	.CC21	.C025	.0017	.0039	.005
	3C.CO	.0C16	.0018	.0014	.C024	.004
	4C.00	.CC17	.C016	C013	.C024	.C03
	5C.00	.CC15	.C017	.0011	.0024	.003
	6C.CC	.0C15	.C02C	.0010	.C030	.004
	7C.OC	.0C23	.C022	.0016	.C035	.005
	8C.00	.CC54	.C049	.0032	.C093	.011

DATA SET NUMBER PHI(R) =180.0	THETA(R) (CEG)	29 RCF(LL) (1/SR)	30 RCF(PL) (1/SR)	31 RCF(LP) (1/SR)	32 RCF(PP) (1/SR)	CCMPUTEC RDF(OT) (1/SR)
	G.CO	.0C36	.C025	.0027	.C042	.006
	1C.00	.C042	.CC28	.0028	.0046	.007
	2C.00	.CC57	.C036	.0037	.0059	.009
	3C.C0	.0C86	.C046	.0047	.0081	.013
	4C.CC	.01C1	.C058	.0052	.C114	.016
	5C.CC					
	6C.CC	.0128	.C079	.0064	.0162	.022
	7C.00	.0145	.C08C	.0078	.0155	.023
	8C.00	.0193	.C086	.0109	.0157	.027

AC1227-C01

TITLE
MERION BLUE GRASS SOD FRESHLY OBTAINED, 3 IN. GRASS BLADES, SANDY LOAM SOIL NOT VISIBLE
SUBJECT CODES
BGCM
DATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 40
PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	33 RDF(LL) (1/SR)	34 RDF(PL) (1/SR)	35 RDF(LP) (1/SR)	36 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0016	.0021	.0012	.0030	.004
	10.00	.0018	.0020	.0013	.0029	.004
	20.00	.0017	.0014	.0012	.0020	.003
	30.00	.0012	.0012	.0009	.0018	.003
	40.00	.0011	.0011	.0008	.0018	.002
	50.00	.0010	.0011	.0008	.0017	.002
	60.00	.0010	.0015	.0007	.0022	.003
	70.00	.0040	.0039	.0024	.0070	.009
	80.00	.0046	.0045	.0026	.0092	.010

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	37 RDF(LL) (1/SR)	38 RDF(PL) (1/SR)	39 RDF(LP) (1/SR)	40 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0016	.0021	.0012	.0030	.004
	10.00	.0026	.0023	.0019	.0035	.005
	20.00	.0034	.0028	.0023	.0046	.007
	30.00	.0064	.0045	.0038	.0077	.011
	40.00	.0088	.0059	.0047	.0106	.015
	50.00	.0121	.0069	.0058	.0129	.019
	60.00					
	70.00	.0302	.0124	.0126	.0230	.039
	80.00	.0471	.0173	.0207	.0323	.059

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AC1327-C01

     TITLE
         MERICN BLUE GRASS SCC FRESHLY CBTAINEC, 3 IN. GRASS BLACES,
         SANCY LCAM SOIL NCT VISIBLE
     SUBJECT CCDES
         BGCM
     CATA SET NUMBERS
          41, 42, 43, 44, 45, 46, 47, 48
     PARAMETER INFORMATICN
         SOURCE=  DKI     GAMMA(C)=.9C    INSTRUMENTATICN= CLA
         ACCLRACY= FIVE PERCENT    NLMBER CF RUNS AVERAGEC= 1
         THETA(I)= 70.CC    PHI(I)=18C.00    WAVELENGTH=  .633
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DATA SET NUMBER		41	42	43	44	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0C13	.C015	.0010	.0024	.003
	1C.CO	.0C12	.C013	.0009	.0020	.003
	2C.00	.0C1C	.0011	.0007	.0018	.002
	3C.CO	.0CC9	.001C	.0006	.C016	.002
	4C.00	.0CC8	.C01C	.0006	.0022	.002
	5C.00	.0CC9	.C011	.0006	.0017	.002
	6C.C0	.0C37	.C024	.0020	.C046	.006
	7C.C0	.0C41	.C021	.0020	.0041	.006
	8C.00	.0C24	.C019	.0014	.0036	.005

DATA SET NUMBER		45	46	47	48	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.0C13	.C015	.0010	.0024	.003
	1C.00	.0C16	.CC13	.0012	.0021	.003
	2C.C0	.0C26	.CC2C	.0017	.0036	.005
	3C.00	.0C38	.C028	.0024	.0152	.007
	4C.00	.0C99	.0053	.0050	.0103	.015
	5C.00	.0159	.C081	.0075	.0152	.023
	6C.00	.C130	.0087	.0080	.C175	.027
	7C.C0					
	8C.C0	.0517	.C287	.0237	.0688	.086

AC1324-C01

TITLE
MATURE MULBERRY LEAF, 2 HOURS OLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSH, IN AUGUST 1967
SUBJECT CODES
BGDV
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.0625	.0043	.0042	.0817	.076
	20.00	.0308	.0039	.0038	.0337	.036
	30.00	.0172	.0040	.0040	.0169	.021
	40.00	.0104	.0042	.0040	.0106	.015
	50.00	.0079	.0041	.0039	.0093	.013
	60.00	.0071	.0046	.0032	.0087	.012
	70.00	.0071	.0042	.0038	.0089	.012
	80.00	.0059	.0056	.0034	.0093	.012

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.0644	.0040	.0039	.0773	.075
	20.00	.0348	.0041	.0038	.0348	.039
	30.00	.0166	.0038	.0035	.0157	.020
	40.00	.0093	.0040	.0040	.0105	.014
	50.00	.0083	.0040	.0038	.0092	.013
	60.00	.0072	.0043	.0041	.0087	.012
	70.00	.0070	.0045	.0038	.0084	.012
	80.00	.0052	.0040	.0037	.0091	.011

AC1324-C01

TITLE
MATLRE MULBERRY LEAF, 2 HCLRS CLC, PICKEC FRCM THE SCUTHEAST SIDE CF THE BLSH, IN ALGLST 1967
SUBJECT CCDES
8GDV
CATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(0)=.9C INSTRLMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 20.CC PHI(I)=18C.CO WAVELENGTH= .633

DATA SET NUMBER		9	10	11	12	COMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.C333	.C036	.0038	.0347	.038
	1C.00	.C538	.C04C	.0040	.0822	.072
	2C.00	.061C	.C041	.0043	.1315	.100
	3C.CC	.0474	.C042	.0041	.1121	.084
	4C.CO	.0269	.C041	.0040	.0645	.050
	5C.00	.C154	.C045	.0045	.0323	.028
	6C.CC	.CC94	.C047	.0043	.0208	.020
	7C.CO	.01C2	.C055	.0041	.0141	.017
	8C.CO	.0C67	.0051	.0042	.0211	.019

DATA SET NUMBER		13	14	15	16	COMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=18C.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.C333	.C036	.0038	.0347	.038
	1C.CC	.C172	.C04C	.0042	.0150	.020
	2C.CO					
	3C.CO	.0C89	.C041	.0038	.0083	.013
	4C.00	.0075	.C039	.0041	.0074	.011
	5C.00	.CC66	.C042	.0035	.0070	.011
	6C.00	.0C65	.C042	.0041	.0065	.01.
	7C.CO	.0C66	.C047	.0037	.0068	.011
	8C.00	.0C50	.0035	.C029	.0061	.009

AC1324-C01

TITLE
MATURE MULBERRY LEAF, 2 HOURS OLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSH, IN AUGUST 1967

SUBJECT CODES
BGDV

DATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0104	.0034	.0042	.0105	.014
	10.00	.0161	.0036	.0039	.0207	.022
	20.00	.0278	.0042	.0042	.0603	.048
	30.00	.0416	.0050	.0047	.1683	.110
	40.00	.0397	.0052	.0049	.2990	.174
	50.00	.0266	.0057	.0051	.3667	.202
	60.00	.0132	.0057	.0052	.2618	.143
	70.00	.0072	.0062	.0054	.1454	.082
	80.00	.0135	.0062	.0059	.1050	.065

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	21 RDF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0104	.0034	.0042	.0105	.014
	10.00	.0081	.0039	.0038	.0082	.012
	20.00	.0075	.0037	.0038	.0071	.011
	30.00	.0076	.0042	.0041	.0073	.012
	40.00					
	50.00	.0074	.0045	.0041	.0068	.011
	60.00	.0074	.0041	.0037	.0060	.011
	70.00	.0073	.0047	.0035	.0061	.011
	80.00	.0065	.0041	.0035	.0065	.010

AC1324-C01

TITLE
MATURE MULBERRY LEAF, 2 HOURS OLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSH, IN AUGUST 1967

SUBJECT CODES
BGDV

DATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATION
SOURCE= DKI   GAMMA(C)=.90   INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
THETA(I)= 50.00   PHI(I)=180.00   WAVELENGTH= .633

DATA SET NUMBER		25	26	27	28	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0076	.0035	.0038	.0091	.012
	10.00	.0099	.0035	.0042	.0135	.016
	20.00	.0158	.0044	.0046	.0312	.028
	30.00	.0220	.0044	.0043	.1014	.066
	40.00	.0264	.0059	.0052	.3399	.189
	50.00	.0193	.0070	.0064	.6731	.353
	60.00	.0112	.0065	.0067	.7692	.397
	70.00	.0227	.0075	.0068	.6634	.350
	80.00	.0623	.0060	.0059	.5051	.290

DATA SET NUMBER		29	30	31	32	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0076	.0035	.0038	.0091	.012
	10.00	.0068	.0038	.0038	.0072	.011
	20.00	.0066	.0038	.0038	.0069	.011
	30.00	.0072	.0037	.0038	.0066	.011
	40.00	.0077	.0043	.0042	.0069	.012
	50.00					
	60.00	.0082	.0043	.0042	.0072	.012
	70.00	.0077	.0040	.0048	.0066	.012
	80.00	.0068	.0046	.0040	.0070	.011

AC1324-C01

TITLE
MATURE MULBERRY LEAF, 2 HOURS OLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSH, IN AUGUST 1967
SUBJECT CODES
BGDV
DATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 40
PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER		33	34	35	36	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0065	.0036	.0041	.0081	.011
	10.00	.0073	.0038	.0047	.0136	.014
	20.00	.0094	.0046	.0045	.0200	.019
	30.00	.0118	.0050	.0050	.0593	.041
	40.00	.0131	.0053	.0056	.2020	.113
	50.00	.0110	.0065	.0064	.6920	.358
	60.00	.0298	.0083	.0077	1.581	.813
	70.00	.1369	.0092	.0081	2.411	1.283
	80.00	.4272	.0113	.0105	2.788	1.618

DATA SET NUMBER		37	38	39	40	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.0065	.0036	.0041	.0081	.011
	10.00	.0064	.0036	.0039	.0071	.011
	20.00	.0068	.0034	.0040	.0068	.010
	30.00	.0067	.0037	.0038	.0064	.010
	40.00	.0071	.0041	.0042	.0066	.011
	50.00	.0080	.0047	.0041	.0072	.012
	60.00					
	70.00	.0097	.0050	.0040	.0079	.013
	80.00	.0090	.0035	.0027	.0065	.011

AC1324-C01

TITLE
MATURE MULBERRY LEAF, 2 HOURS OLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSH, IN AUGUST 1967

SUBJECT CODES
BGDV

DATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48

PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.9C INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 70.00 PHI(I)=180.00 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	41 RDF(LL) (1/SR)	42 RDF(PL) (1/SR)	43 RDF(LP) (1/SR)	44 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0062	.0036	.0041	.0082	.011
	10.00	.0065	.0038	.0042	.0108	.013
	20.00	.0072	.0048	.0044	.0191	.018
	30.00	.0081	.0046	.0051	.0367	.027
	40.00	.0093	.0050	.0058	.1258	.073
	50.00	.0202	.0097	.0068	.5335	.285
	60.00	.1146	.0089	.0081	2.037	1.084
	70.00	.5954	.0122	.0107	5.514	3.066
	80.00	2.287	.0180	.0147	11.131	6.725

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	45 RDF(LL) (1/SR)	46 RDF(PL) (1/SR)	47 RDF(LP) (1/SR)	48 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0062	.0036	.0041	.0082	.011
	10.00	.0058	.0036	.0038	.0070	.010
	20.00	.0061	.0037	.0036	.0065	.010
	30.00	.0066	.0038	.0039	.0064	.010
	40.00	.0070	.0041	.0044	.0065	.011
	50.00	.0082	.0041	.0045	.0068	.012
	60.00	.0098	.0038	.0053	.0069	.013
	70.00					
	80.00	.0136	.0052	.0050	.0128	.018

AC119C-C01

TITLE
SMOKED MAGNESIUM OXIDE ON ALUMINUM PLATE
(APPROXIMATELY 1.75 TO 2 MM DEPOSIT).
SUBJECT CODES
CJAAA
DATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DXI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1751	.1310	.1352	.1663	.304
	20.00	.1746	.1307	.1402	.1636	.305
	30.00	.1750	.1320	.1409	.1659	.307
	40.00	.1691	.1272	.1389	.1594	.297
	50.00	.1625	.1246	.1365	.1600	.292
	60.00	.1526	.1187	.1298	.1612	.281
	70.00	.1425	.1082	.1270	.1484	.263
	80.00	.1280	.1023	.1120	.1561	.249

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1760	.1434	.1380	.1806	.319
	20.00	.1737	.1373	.1387	.1731	.311
	30.00	.1696	.1366	.1365	.1728	.308
	40.00	.1654	.1330	.1349	.1651	.299
	50.00	.1560	.1277	.1298	.1645	.289
	60.00	.1472	.1236	.1247	.1642	.280
	70.00	.1322	.1089	.1158	.1487	.253
	80.00	.1165	.1024	.1019	.1552	.238

AC119C-CC1

TITLE
SMOKED MAGNESIUM CXIDE CN ALUMINUM PLATE
(APPRCXIMATELY 1.75 TC 2 MM CEPOSIT).
SUBJECT CODES
CJAAA
DATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATICN
SOURCE= DKI GAMMA(O)=.9C INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1
THETA(I)= 20.CC PHI(I)= 18C.0 WAVELENGTH= .633

DATA SET NUMBER		9	10	11	12	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1538	.1514	.1222	.1844	.306
	1C.CC	.1540	.1531	.1232	.1885	.309
	2C.00	.1493	.1491	.1237	.1850	.304
	3C.00	.1458	.1474	.1236	.1872	.302
	4C.00	.1387	.1450	.1207	.1839	.294
	5C.00	.1346	.143C	.1177	.188C	.292
	6C.00	.1281	.1341	.1135	.1928	.284
	7C.CC	.1182	.1230	.1042	.1935	.269
	8C.00	.1132	.1C72	.0965	.1932	.255

DATA SET NUMBER		13	14	15	16	CCMPUTEC
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.1538	.1514	.1222	.1844	.306
	1C.00	.1625	.1499	.1247	.1838	.310
	2C.CC					
	3C.00	.1693	.1485	.1270	.1867	.316
	4C.00	.1699	.1462	.1264	.1870	.315
	5C.00	.1681	.1432	.1242	.1850	.310
	6C.00	.1581	.1373	.1192	.1847	.300
	7C.00	.14C6	.1277	.1090	.1752	.276
	80.00	.1345	.1186	.1041	.1689	.263

AC119C-C01

TITLE
SMOKED MAGNESIUM OXIDE ON ALUMINUM PLATE
(APPROXIMATELY 1.75 TO 2 MM DEPOSI...
SUBJECT CODES
CJAAA
DATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.9C INSTRUMENTATION= CL4
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)= 180.0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1625	.1276	.1331	.1600	.292
	10.00	.1566	.1300	.1342	.1679	.294
	20.00	.1504	.1285	.1338	.1700	.291
	30.00	.1516	.1297	.1314	.1760	.294
	40.00	.1522	.1286	.1294	.1865	.298
	50.00	.1463	.1268	.1233	.1977	.297
	60.00	.1457	.1217	.1173	.2073	.296
	70.00	.1511	.1121	.1112	.2019	.288
	80.00	.1586	.1030	.0999	.2400	.301

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	21 RDF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1625	.1264	.1331	.1587	.290
	10.00	.1649	.1333	.1295	.1680	.298
	20.00	.1709	.1297	.1291	.1633	.296
	30.00	.1741	.1263	.1226	.1607	.292
	40.00					
	50.00	.1846	.1233	.1207	.1715	.300
	60.00	.1777	.1210	.1140	.1690	.291
	70.00	.1716	.1116	.1113	.1568	.276
	80.00	.1567	.1054	.0991	.1571	.259

AC119C-C01

TITLE
SMOKED MAGNESIUM OXIDE ON ALUMINUM PLATE
(APPROXIMATELY 1.75 TO 2 MM DEPOSIT).
SUBJECT CODES
CJAAA
DATA SET NUMBERS
25, 26 27, 28, 29, 30, 31, 32
PARAMETER INFORMATION
SOURCE= DKI GAMMA(C)=.9C INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.0C PHI(I)= 18C.0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	25 RDF(LL) (1/SR)	26 RDF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO	.1479	.1229	.1272	.1633	.281
	1C.00	.1452	.1248	.1289	.1706	.285
	2C.CC	.1387	.1268	.1251	.1797	.285
	3C.00	.1443	.1246	.1232	.1929	.292
	4C.00	.1531	.1237	.1230	.2095	.305
	5C.CC	.177C	.1212	.1200	.2438	.331
	6C.00	.2251	.1201	.1176	.3078	.385
	7C.00	.2600	.1137	.1123	.3349	.410
	8C.CO	.3352	.1077	.1038	.4152	.481

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	29 RDF(LL) (1/SR)	30 RDF(PL) (1/SR)	31 RDF(LP) (1/SR)	32 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00	.1479	.1229	.1272	.1633	.281
	1C.00	.1555	.1149	.1257	.1586	.277
	2C.00	.1630	.1135	.1222	.1533	.276
	3C.00	.1751	.1123	.1216	.1534	.281
	4C.00	.1822	.1085	.1173	.1510	.279
	5C.CC	.1922	.1059	.1134	.1533	.282
	6C.00					
	7C.00	.2077	.0969	.1029	.1643	.286
	8C.00	.1938	.0862	.0907	.1519	.261

AC1317-C01

TITLE
MAGNESIUM OXIDE, PRESSED AT 4200 PSI, AGAINST INK BLOTTER PAPER.
SUBJECT CODES
CJAAB
DATA SET NUMBERS
1, 2, 3, 4
PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.1908	.1437	.1385	.1822	.328
	20.00	.1794	.1421	.1361	.1799	.319
	30.00	.1764	.1407	.1400	.1733	.315
	40.00	.1696	.1416	.1366	.1754	.312
	50.00	.1[illegible]23	.1399	.1342	.1763	.306
	60.00	.1568	.1378	.1316	.1743	.300
	70.00	.1525	.1376	.1317	.1722	.297
	80.00	.145[illegible]	.1361	.1279	.1744	.29[illegible]

AC1317-C01

TITLE
MAGNESIUM OXIDE, PRESSED AT 4200 PSI, AGAINST INK BLOTTER PAPER.
SUBJECT CODES
CJAAB
DATA SET NUMBERS
5, 6, 7, 8, 9, 10, 11, 12
PARAMETER INFORMATION
SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)= 180.0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1763	.1454	.1424	.1813	.323
	10.00	.1701	.1420	.1432	.1827	.319
	20.00	.1604	.1424	.1384	.1827	.312
	30.00	.1603	.1391	.1425	.1812	.312
	40.00	.1519	.1410	.1398	.1928	.313
	50.00	.1515	.1386	.1351	.1938	.309
	60.00	.1491	.1338	.1335	.1920	.304
	70.00	.1472	.1302	.1268	.1958	.300
	80.00	.1565	.1320	.1220	.2147	.313

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	9 RDF(LL) (1/SR)	10 RDF(PL) (1/SR)	11 RDF(LP) (1/SR)	12 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1763	.1454	.1424	.1813	.323
	10.00	.1813	.1453	.1468	.1827	.328
	20.00	.1923	.1458	.1435	.1861	.334
	30.00	.1985	.1460	.1374	.1913	.337
	40.00					
	47.00	.2157	.1544	.1407	.2108	.361
	50.00	.2081	.1501	.1415	.2031	.351
	60.00	.2014	.1531	.1379	.1995	.346
	70.00	.1924	.1524	.1385	.1943	.339
	80.00	.1785	.1459	.1307	.1883	.322

AC1192-001

TITLE
FLOWERS OF SULPHUR, MANUALLY PRESSED INTO PLASTIC CONTAINER APPROXIMATELY 2.5 X 2.5 X .25 IN.
SUBJECT CODES
CJAC
DATA SET NUMBERS
1, 2, 3, 4
PARAMETER INFORMATION
SOURCE= DKI GAMMA(O)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1498	.1390	.1345	.1453	.284
	20.00	.1487	.1357	.1352	.1457	.285
	30.00	.1467	.1398	.1350	.1460	.284
	40.00	.1415	.1346	.1290	.1409	.273
	50.00	.1386	.1320	.1261	.1391	.268
	60.00	.1290	.1252	.1202	.1313	.253
	70.00	.1194	.1184	.1105	.1267	.237
	80.00	.1031	.1006	.0918	.1109	.203

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AC1191-CO1

     TITLE
         FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT,
         (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
     SUBJECT CODES
         CJAE
     DATA SET NUMBERS
           1,  2
     PARAMETER INFORMATION
         SOURCE=  DKH     GAMMA(O)=        INSTRUMENTATION= CLA
         ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
         THETA(I)=      0   PHI(I)=      0   WAVELENGTH=  .425

DATA SET NUMBER          1          2        COMPUTED
 PHI(R)   THETA(R)   RDF(LT)    RDF(PT)    RDF(OT)
 =    0    (DEG)      (1/SR)     (1/SR)     (1/SR)

            0.00
            7.00      .3296      .3296       .330
           10.00      .3264      .3264       .326
           15.00      .3268      .3268       .327
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AC1191-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.

SUBJECT CODES
CJAE

DATA SET NUMBERS
3, 4, 5, 6

PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 80.00 PHI(I)= 180.0 WAVELENGTH= .425

DATA SET NUMBER		3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00	.2646	.3699	.317
	20.00	.3357	.3970	.366
	40.00	.5775	.6817	.630
	60.00	.3680	1.791	1.079
	80.00			

DATA SET NUMBER		5	6	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00	.2646	.3699	.317
	20.00	.2346	.3937	.314
	40.00	.2533	.3541	.304
	60.00	.2822	.4933	.388
	70.00	.3352	.5769	.456
	80.00			

AC1191-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
7, 8, 9, 10
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 80.00 PHI(I)= 180.0 WAVELENGTH= .550

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	7 RDF(LT) (1/SR)	8 RDF(PT) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0739	.2362	.155
	20.00	.2673	.2962	.282
	40.00	.4372	.4955	.466
	60.00	1.051	1.271	1.161
	80.00			

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	9 RDF(LT) (1/SR)	10 RDF(PT) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.0739	.2362	.155
	20.00	.1310	.2334	.182
	40.00	.2186	.2350	.227
	60.00	.3842	.2362	.310
	70.00	.6264	.3120	.469
	80.00			

AC1191-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
11, 12, 13, 14
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY- FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 80.00 PHI(I)= 180.0 WAVELENGTH= .750

DATA SET NUMBER		11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00	.2173	.2137	.215
	20.00	.2592	.2709	.265
	40.00	.4181	.4480	.433
	60.00	1.017	1.148	1.082
	80.00	4.821	5.447	5.134

DATA SET NUMBER		13	14	COMPUTED
PHI(R)	THETA(R)	RDF(LT)	RDF(PT)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)
	0.00	.2173	.2137	.215
	20.00	.2044	.2008	.203
	40.00	.1965	.2069	.202
	60.00	.2160	.2199	.218
	70.00	.2227	.2480	.235
	80.00			

AC1191-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.

SUBJECT CODES
CJAE

DATA SET NUMBERS
15, 16, 17, 18

PARAMETER INFORMATION
SOURCE= DKH   GAMMA(O)=   INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
THETA(I)= 80.00   PHI(I)= 180.0   WAVELENGTH= 1.100

DATA SET NUMBER PHI(R) = 0	 THETA(R) (DEG)	15 RDF(LT) (1/SR)	16 RDF(PT) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.2166	.2281	.222
	20.00	.2677	.2829	.275
	40.00	.4239	.4628	.443
	60.00	1.087	1.224	1.155
	80.00	3.000	6.269	4.634

DATA SET NUMBER PHI(R) =180.0	 THETA(R) (DEG)	17 RDF(LT) (1/SR)	18 RDF(PT) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.2166	.2281	.222
	20.00	.2039	.2081	.206
	40.00	.2033	.2102	.207
	60.00	.2014	.2242	.213
	70.00	.2069	.2490	.228
	80.00			

AC1191-CC2

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
1, 2, 3, 4
PARAMETER INFORMATION
SOURCE= DKH   GAMMA(0)=   INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT   NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0   PHI(I)= 0   WAVELENGTH= .550

DATA SET NUMBER		1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00					
	7.00	.2142	.1474	.1404	.2063	.354
	10.00	.2031	.1486	.1415	.2045	.349
	15.00	.2025	.1515	.1443	.2059	.352

AC1191-CC2

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
5, 6, 7, 8
PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .750

DATA SET NUMBER		5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(CT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	7.00	.1990	.1455	.1400	.1931	.339
	10.00	.1951	.1429	.1394	.1908	.334
	15.00	.1951	.1466	.1422	.1945	.339

AC1191-CC2

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
9, 10, 11, 12
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.100

DATA SET NUMBER		9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	7.00	.1952	.1469	.1390	.1962	.339
	10.00	.1905	.1443	.1395	.1910	.333
	15.00	.1914	.1484	.1427	.1904	.336

AC1191-CC2

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
13, 14, 15, 16
PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= C PHI(I)= C WAVELENGTH= 1.100

DATA SET NUMBER PHI(R) = 9C.0	THETA(R) (DEG)	13 RDF(LL) (1/SR)	14 RDF(PL) (1/SR)	15 RDF(LP) (1/SR)	16 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CC					
	7.00	.1978	.1416	.1408	.1919	.336
	10.00	.1971	.1389	.1402	.1856	.331
	15.00	.1980	.1409	.1429	.1846	.333

AC1191-CC2

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE
DATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= .633

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	17 RDF(LL) (1/SR)	18 RDF(PL) (1/SR)	19 RDF(LP) (1/SR)	20 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1851	.1270	.1234	.1803	.308
	20.00	.1757	.1245	.1252	.1709	.298
	30.00	.1671	.1249	.1245	.1584	.287
	40.00	.1561	.1201	.1193	.1505	.273
	50.00	.1456	.1180	.1107	.1476	.261
	60.00	.1389	.1084	.1037	.1375	.244
	70.00	.1323	.1001	.0953	.1326	.230
	80.00	.1181	.0848	.0799	.1185	.201

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	21 RDF(LL) (1/SR)	22 RDF(PL) (1/SR)	23 RDF(LP) (1/SR)	24 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00					
	10.00	.1932	.1326	.1316	.1902	.324
	20.00	.1817	.1333	.1301	.1792	.312
	30.00	.1694	.1276	.1266	.1655	.295
	40.00	.1596	.1263	.1218	.1585	.283
	50.00	.1463	.1217	.1121	.1505	.265
	60.00	.1410	.1132	.1054	.1461	.253
	70.00	.1319	.0982	.0949	.1313	.228
	80.00	.1194	.0840	.0817	.1183	.202

AC1191-CC2

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), ON 1/4 IN. PLYWOOD BACKING.

SUBJECT CODES
CJAE

DATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)= 180.0 WAVELENGTH= .633

DATA SET NUMBER		25	26	27	28	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1543	.1180	.1198	.1532	.273
	10.00	.1610	.1234	.1236	.1600	.284
	20.00	.1687	.1243	.1275	.1676	.294
	30.00	.1817	.1312	.1309	.1855	.315
	40.00	.1949	.1356	.1324	.2056	.334
	50.00	.2162	.1317	.1298	.2286	.353
	60.00	.2405	.1287	.1204	.2556	.373
	70.00	.2775	.1177	.1150	.2907	.400
	80.00		.1051		.3344	

DATA SET NUMBER		29	30	31	32	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1543	.1180	.1198	.1532	.273
	10.00	.1536	.1186	.1197	.1520	.272
	20.00	.1532	.1147	.1141	.1480	.265
	30.00	.1494	.1109	.1101	.1493	.260
	40.00					
	50.00	.1380	.1031	.1021	.1427	.243
	60.00	.1327	.0987	.0955	.1332	.230
	70.00	.1200	.0896	.0862	.1210	.208
	80.00	.1007		.0712		

AC1293-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT CN 1/4 IN. PLYWCCD BACKING.
SUBJECT CODES
CJAE ECBBJ
CATA SET NUMBERS
1, 2, 3, 4, 5, 6, 7, 8
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 0 PHI(I)= 0 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	1 RDF(LL) (1/SR)	2 RDF(PL) (1/SR)	3 RDF(LP) (1/SR)	4 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.CO					
	1C.CO	.2C68	.1386	.1497	.1939	.344
	2C.00	.1983	.1369	.1460	.1780	.330
	3C.00	.1918	.1376	.1467	.1721	.324
	4C.00	.1811	.1263	.1421	.1615	.306
	5C.00	.1775	.1222	.1369	.1542	.295
	6C.00	.1703	.1154	.1293	.1472	.281
	7C.00	.1615	.1044	.1170	.1399	.261
	8C.00	.1432	.0897	.1010	.1263	.230

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	5 RDF(LL) (1/SR)	6 RDF(PL) (1/SR)	7 RDF(LP) (1/SR)	8 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	C.00					
	1C.00	.2C90	.1365	.1488	.1917	.343
	2C.00	.1997	.1353	.1480	.1785	.331
	3C.CO	.1921	.1334	.1458	.1717	.321
	4C.00	.1847	.1320	.1412	.1641	.311
	5C.CO	.1772	.1254	.1341	.1605	.299
	6C.CO	.17C0	.1202	.1266	.1547	.286
	7C.00	.1582	.1084	.1133	.1455	.263
	8C.00	.1411	.0916	.0962	.1305	.230

AC1293-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT ON 1/4 IN. PLYWOOD BACKING.

SUBJECT CODES
CJAE ECBBJ

DATA SET NUMBERS
9, 10, 11, 12, 13, 14, 15, 16

PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 20.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER		9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1949	.1291	.1434	.1664	.317
	10.00	.1946	.1390	.1470	.1763	.328
	20.00	.1891	.1370	.1442	.1756	.323
	30.00	.1898	.1398	.1463	.1787	.327
	40.00	.1864	.1324	.1437	.1716	.317
	50.00	.1876	.1283	.1406	.1730	.315
	60.00	.1885	.1213	.1307	.1725	.306
	70.00	.1908	.1144	.1229	.1759	.302
	80.00	.1868	.1002	.1092	.1739	.285

DATA SET NUMBER		13	14	15	16	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1949	.1291	.1434	.1664	.317
	10.00	.1900	.1305	.1423	.1735	.318
	20.00					
	30.00	.1814	.1248	.1379	.1654	.305
	40.00	.1734	.1223	.1324	.1555	.292
	50.00	.1637	.1154	.1258	.1441	.274
	60.00	.1552	.1079	.1179	.1369	.259
	70.00	.1412	.0984	.1064	.1266	.236
	80.00	.1252	.0853	.0912	.1140	.208

AC1293-001

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT CN 1/4 IN. PLYWCCD BACKING.
SUBJECT CODES
CJAE ECBBJ
CATA SET NUMBERS
17, 18, 19, 20, 21, 22, 23, 24
PARAMETER INFORMATICN
SOURCE= DKH GAMMA(C)= INSTRUMENTATICN= CLA
ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1
THETA(I)= 30.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER		17	18	19	20	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.1668	.1313	.1296	.1663	.297
	1C.00	.1700	.1367	.1325	.1737	.306
	2C.00	.1744	1428	.1355	.1811	.317
	3C.00	.1819	.1445	.1407	.1880	.328
	4C.00	.1848	.1443	.1386	.1954	.332
	5C.00	.1913	.1411	.1350	.2024	.335
	6C.00	.2016	.1378	.1321	.2147	.343
	7C.00	.2116	.1273	.1226	.2260	.344
	8C.00	.2220	.1132	.1116	.2336	.340

DATA SET NUMBER		21	22	23	24	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00	.1668	.1313	.1296	.1663	.297
	1C.00	.1638	.1269	.1241	.1607	.288
	2C.00	.1599	.1258	.1224	.1660	.287
	3C.00					
	4C.00	.1529	.1212	.1155	.1627	.276
	5C.00	.1487	.1191	.1129	.1527	.267
	6C.00	.1408	.1132	.1075	.1430	.252
	7C.00	.1321	.1048	.0996	.1345	.235
	8C.00	.1176	.0942	.0876	.1232	.211

AC1293-CO1

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT ON 1/4 IN. PLYWOOD BACKING.

SUBJECT CODES
CJAE ECBBJ

DATA SET NUMBERS
25, 26, 27, 28, 29, 30, 31, 32

PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 40.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	25 RDF(LL) (1/SR)	26 RDF(PL) (1/SR)	27 RDF(LP) (1/SR)	28 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1620	.1325	.1284	.1655	.294
	10.00	.1671	.1370	.1307	.1758	.305
	20.00	.1751	.1402	.1340	.1828	.326
	30.00	.1873	.1432	.1389	.1978	.334
	40.00	.1996	.1435	.1394	.2117	.347
	50.00	.2211	.1442	.1390	.2332	.369
	60.00	.2456	.1400	.1333	.2591	.389
	70.00	.2804	.1333	.1264	.2917	.416
	80.00	.3270	.1197	.1134	.3221	.439

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	29 RDF(LL) (1/SR)	30 RDF(PL) (1/SR)	31 RDF(LP) (1/SR)	32 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1620	.1325	.1284	.1655	.294
	10.00	.1607	.1305	.1262	.1631	.290
	20.00	.1567	.1236	.1205	.1570	.279
	30.00	.1524	.1235	.1173	.1621	.278
	40.00					
	50.00	.1449	.1169	.1091	.1568	.264
	60.00	.1396	.1124	.1030	.1475	.251
	70.00	.1274	.1026	.0936	.1357	.230
	80.00	.1148	.0926	.0817	.1245	.207

AC1293-001

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT ON
1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE ECBBJ
DATA SET NUMBERS
33, 34, 35, 36, 37, 38, 39, 40
PARAMETER INFORMATION
SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 5[illegible].00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER PHI(R) = 0	THETA(R) (DEG)	33 RDF(LL) (1/SR)	34 RDF(PL) (1/SR)	35 RDF(LP) (1/SR)	36 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1632	.1239	.1296	.1589	.288
	10.00	.1728	.1268	.1352	.1671	.301
	20.00	.1863	.1323	.1407	.1834	.321
	30.00	.2015	.1372	.1438	.2047	.344
	40.00	.2291	.1435	.1456	.2417	.380
	50.00	.2678	.1464	.1548	.2912	.430
	60.00	.3356	.1466	.1491	.3545	.493
	70.00	.4043	.1406	.1396	.4426	.564
	80.00	.5176	.1315	.1305	.5596	.670

DATA SET NUMBER PHI(R) =180.0	THETA(R) (DEG)	37 RDF(LL) (1/SR)	38 RDF(PL) (1/SR)	39 RDF(LP) (1/SR)	40 RDF(PP) (1/SR)	COMPUTED RDF(OT) (1/SR)
	0.00	.1632	.1239	.1296	.1589	.288
	10.00	.1544	.1194	.1237	.1506	.274
	20.00	.1540	.1179	.1217	.1486	.271
	30.00	.1501	.1141	.1153	.1461	.263
	40.00	.1480	.1108	.1122	.1489	.260
	50.00					
	60.00	.1431	.1040	.1050	.1475	.250
	70.00	.1374	.0974	.0979	.1357	.234
	80.00	.1258	.0853	.0862	.1235	.210

AC1293-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE ECBBJ
DATA SET NUMBERS
41, 42, 43, 44, 45, 46, 47, 48
PARAMETER INFORMATION
SOURCE= DKH GAMMA(O)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 60.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER		41	42	43	44	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1455	.1115	.1139	.1447	.258
	10.00	.1569	.1192	.1184	.1619	.278
	20.00	.1734	.1231	.1245	.1815	.301
	30.00	.1989	.1302	.1297	.2140	.336
	40.00	.2402	.1372	.1344	.2671	.389
	50.00	.3081	.1442	.1389	.3503	.471
	60.00	.4220	.1488	.1414	.4806	.596
	70.00	.5859	.1475	.1413	.6731	.774
	80.00	.8577	.1414	.1370	.9745	1.055

DATA SET NUMBER		45	46	47	48	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1455	.1115	.1139	.1447	.258
	10.00	.1407	.1092	.1121	.1404	.251
	20.00	.1371	.1058	.1072	.1331	.242
	30.00	.1361	.1045	.1056	.1331	.240
	40.00	.1341	.1031	.0999	.1337	.235
	50.00	.1342	.1024	.0986	.1452	.240
	60.00					
	70.00	.1315	.0958	.0900	.1489	.233
	80.00	.1305	.0888	.0835	.1408	.222

AC1293-C01

TITLE
FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT ON 1/4 IN. PLYWOOD BACKING.
SUBJECT CODES
CJAE ECBBJ
DATA SET NUMBERS
49, 50, 51, 52, 53, 54, 55, 56
PARAMETER INFORMATION
SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 70.00 PHI(I)=180.00 WAVELENGTH= 1.060

DATA SET NUMBER		49	50	51	52	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1366	.1035	.1033	.1399	.242
	10.00	.1455	.1046	.1061	.1508	.253
	20.00	.1691	.1121	.1133	.1766	.286
	30.00	.2028	.1180	.1182	.2180	.328
	40.00	.2605	.1262	.1249	.2872	.399
	50.00	.3686	.1338	.1351	.4070	.522
	60.00	.5592	.1423	.1406	.6247	.733
	70.00	.8992	.1445	.1468	1.023	1.107
	80.00	1.529	.1460	.1439	1.695	1.757

DATA SET NUMBER		53	54	55	56	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1366	.1035	.1033	.1399	.242
	10.00	.1276	.1000	.0986	.1293	.228
	20.00	.1273	.0997	.1002	.1281	.228
	30.00	.1249	.0965	.0966	.1242	.221
	40.00	.1273	.0980	.0959	.1290	.225
	50.00	.1209	.0878	.0870	.1217	.209
	60.00	.1338	.0942	.0922	.1448	.232
	70.00					
	80.00	.1565	.0952	.0935	.1746	.260

5
RADAR (ACTIVE MICROWAVE) DATA

The active microwave data in the TSAC compilation consists of averaged radar cross sections as a function of aspect angle with frequency as a parameter, and cumulative probability distribution vs. radar cross section. The latter data appear only in the classified supplement.

Each radar data curve has been digitized by the same technique as used for the optical data, and the curves are reproduced on uniform grids. Normalized radar cross section σ_0 in decibels is plotted along the ordinate, and the abscissa represents the angle measured from the normal (aspect angle) in degrees. The header information for each curve, which includes the curve's identification number, title, a coded designation for the type of terrain covered, and parameter information, is also supplied by computer.

5.1. DATA FORMAT

A numerical code is used to identify the radar curves. The number of digits in the code is variable, depending on the number of descriptors required for a particular target or background. Table 5-1 contains the key for interpreting this code. The first digit, always a 3, identifies the curve as being radar data. The second digit, either a 1, 2, or 3, indicates that the curve is for a background, target, or combination of terrain and target, respectively. Third, fourth, and fifth digits, when used, represent successively finer subdivisions of the material class involved. Thus, 31312 represents clay, a subset of soil (3131), which in turn is a subset of terrain (313), which is a background material (31) being measured by radar (3). Table 5-1 also indicates which material classes require still additional descriptors. These are designated by the letters A, B, C, C_1, C_2, C_3, etc., as defined in table 5-2. Table 5-3 explains the parameter information appearing in the curve header. In section 5.3 the radar data are grouped according to the first four digits of the curve identification number.

TABLE 5-1. RADAR DATA NUMERICAL CODE

31	BACKGROUND AND TERRAIN
311	Sky
312	H_2O States
3122 □ *$C_1C_2C_3C_4$	Ice
3123 □ AB	Water
313	Terrain
3131	Soil
$31311C_1C_2C_3C_4$	Sand
$31312C_1C_2C_3C_4$	Clay
$31313C_1C_2C_3C_4$	Loam, cultivated
$31314C_1C_2C_3C_4$	Loam, uncultivated
$31315C_1C_2C_3C_4$	Rock
$31316C_1C_2C_3C_4$	Salt
3132	Trees
$31321C_1C_2C_3C_4$	Leaves, laboratory sample
$31322C_1C_2C_3C_4$	Bark, laboratory sample
$31323C_1C_2C_3C_4$	Broad-leaf trees
$31324C_1C_2C_3C_4$	Narrow-leaf trees
$31325C_1C_2C_3C_4$	Broad-leaf shrubs
$31326C_1C_2C_3C_4$	Narrow-leaf shrubs
3133	Crops
$31331C_1C_2C_3C_4$	Grain
$31332C_1C_2C_3C_4$	Broad-leaf crops
$31333C_1C_2C_3C_4$	Grass
$31334C_1C_2C_3C_4$	Mosses, ferns, and fungi
$3134XC_1C_2C_3C_4$	Forest, where X is the percentage of cover
3135 □ $C_1C_2C_3C_4$	Farmland (including farm buildings, etc.)
3136 □ $C_1C_2C_3C_4$	Marsh
3137 □ $C_1C_2C_3C_4$	Desert
314	Space
315	Combinations of Ice, H_2O, and Land
$3151AC_1C_{2_I}C_{3_I}C_{4_I}$	Ice and H_2O
$3152AC_1C_2C_3C_4$	H_2O and land
3153 □ $C_1C_2C_3C_4C_{2_I}$	Ice and land
$3154AC_1C_2C_3C_4C_{2_I}$	Ice, H_2O, and land

*The symbol □ indicates a blank space.

TABLE 5-1. RADAR DATA NUMERICAL CODE (Continued)

32	TARGET
320	Composite areas
3201 □ $C_1C_2C_3C_4$	Industrial area
3202 □ $C_1C_2C_3C_4$	Residential area
3203 □ $C_1C_2C_3C_4$	Rural town area
321	Buildings and building materials
3211	Materials
32111$C_1C_2C_3C_4$	Painted lumber
32112$C_1C_2C_3C_4$	Brick and tile
32113$C_1C_2C_3C_4$	Asphalt
32114$C_1C_2C_3C_4$	Glass
3212 □ $C_1C_2C_3C_4$	Concrete buildings
3213 □ $C_1C_2C_3C_4$	Frame buildings
3214 □ $C_1C_2C_3C_4$	Camouflage, decoys, and temporary structures
3215 □ $C_1C_2C_3C_4$	Steel buildings
322 □ □ C_1 □ □ C_4	Personnel
323 □ □ C_1 □ □ C_4	Surface vehicles
3231 □ C_1 □ □ C_4	Trucks, armor, and painted vehicles
324 □ □ C_1 □ □ C_4	Aircraft
325 □ □ C_1 □ □ C_4	Missiles
328 □ □ $C_1C_2C_3C_4$	Airfields
3290D$C_1C_2C_3C_4$	Pavement, where D is

(1) Asphalt	(4) Concrete	(7) Cinder and gravel
(2) Brick	(5) Gravel	(8) Concrete and gravel
(3) Cinder	(6) Stone	(9) Cinder and dirt

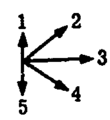
33	COMBINATIONS OF TERRAIN AND TARGETS
3301 □ $C_1C_2C_3C_4$	Orchard with paved highway
3302 □ $C_1C_2C_3C_4$	Desert, highway, and bridges
3303A$C_1C_{2_L}C_{3_I}C_4C_{2_I}$	Water, ice, land, and small buildings

TABLE 5-2. SCALES OF ADDITIONAL DESCRIPTORS FOR RADAR DATA

Scale A: Douglas Sea Scale

Code No.	Description	Wave Height (ft)	Wind Speed (knots)
0	Calm	0	0
1	Smooth	<1	<6.5
2	Slight	1 to 3	6.5 to 12
3	Moderate	3 to 5	12 to 14.5
4	Rough	5 to 8	14.5 to 18
5	Very rough	8 to 12	18 to 23
6	High	12 to 20	23 to 30
7	Very high	20 to 40	30 to 40
8	Mountainous	>40	>40
9	Confused		

Scale B: Wind-Direction Scale



1 indicates antenna direction.

Scale C_1: Season When Measurements Taken

1	Summer: June, July, August
2	Fall: September, October, November
3	Winter: December, January, February
4	Spring: March, April, May

Scale C_2: Small-Scale Roughness

1	Roughness = $<0.01\lambda$
2	Roughness = 0.01λ to 0.05λ
3	Roughness = 0.05λ to 0.10λ
4	Roughness = 0.10λ to 0.50λ
5	Roughness = 0.50λ to 1.00λ
6	Roughness = 1.00λ to 5.00λ
7	Roughness = 5.00λ to 10.00λ
8	Roughness = 10.00λ to 50.00λ
9	Roughness = $>50.00\lambda$

Scale C_3: Large-Scale Roughness

1	Flat
2	Rolling
3	Hilly
4	Mountainous

Scale C_4: Wetness or Snow

1	Dry ground
2	Wet ground (rain)
3	Partially flooded or swampy
4	Snow, $<3\lambda$ deep
5	Snow, 3 to 10λ deep
6	Snow, 10 to 20λ deep
7	Snow, 20 to 50λ deep
8	Snow, 50 to 100λ deep
9	Snow, $>100\lambda$ deep

TABLE 5-3. RADAR DATA PARAMETERS

BAND	Frequency interval of measurement coded as follows:	
	B	Low frequency
	P	0.225 to 0.390 GHz
	L	0.390 to 1.55
	S	1.55 to 3.90
	C	3.90 to 6.20
	X	6.20 to 10.9
	KU	10.9 to 20.9
	KA	20.9 to 36.0
	Q	36.0 to 46.0
	V	46.0 to 56.0
FREQ	Exact frequency of measurement (gigahertz)	
POL	Polarization of transmitted signal and polarization of received signal, coded as follows:	
	VV	Vertical × vertical
	HV	Horizontal × vertical
	RL	Right circular × left circular
	RR	Right circular × right circular
	AV	Average
	HH	Horizontal × horizontal
	VH	Vertical × horizontal
	LR	Left circular × right circular
	LL	Left circular × left circular
LAT	Latitude of measurement	
LONG	Longitude of measurement	
DATE	Date of measurement (day, month, and year)	
RADAR TYPE	Coded as follows:	
	ACC	Airborne cw, coherent
	ACN	Airborne cw, noncoherent
	APC	Airborne pulse, coherent
	APN	Airborne pulse, noncoherent
	GCC	Ground cw, coherent
	GCN	Ground cw, noncoherent
	GPC	Ground pulse, coherent
	GPN	Ground pulse, noncoherent
BEAMWIDTH	Beamwidth between half-power points (degrees)	
RANGE	Range in thousands of feet followed by an R for slant range or an H for altitude.	
AREA	Total sampling area per average point (square feet)	
AVERAGING	Degree of averaging, scaled from 1 (instantaneous) to 9 (very heavily averaged)	
VARIANCE	Variance about curves (decibels)	

5.2. SUMMARY OF EXPERIMENTS YIELDING RADAR DATA

The documents from which the radar data have been extracted are briefly summarized below. These summaries are included to facilitate use of the data presented in section 5.3. Information on the experimental platform, instrumentation, reflectance standards, and other related matters has been included. The code consisting of the letter B and five digits at the beginning of each entry is the accessions number assigned to the document by the Target Signature Analysis Center. All curves extracted from the document carry this accessions number plus a number from 001 to 999 which is an arbitrary designation assigned to specific curves. The two numbers together constitute a curve's identification number. Bibliographical information on each of the documents is included, and the user is referred to the original source if more detailed information is required.

B-03337. Campbell: Backscattering Characteristics of Land and Sea at X-Band, General Precision Laboratory, Inc., Pleasantville, N. Y., May 1958.

Instrumentation

System 1: airborne pulsed radar

Antenna: 18-in.-diameter paraboloid

Polarization: horizontal

Frequency: X-band (λ = 3.4 cm)

Antenna beamwidth: unspecified

Pulse-repetition frequency: 20 kHz

Pulse duration: 1/4 μsec

System 2: airborne pulsed radar

Antenna: a pair of paraboloids, 18-in. diameter

Polarization: vertical, horizontal, cross

Frequency: X-band (λ = 3.4 cm)

Antenna beamwidth (both azimuth and elevation): 5 1/2^{o}

Pulse-repetition frequency: 50 kHz

Pulse duration: 1 μsec

Comments: One antenna was arranged to transmit vertically polarized radiation, and the other was arranged to transmit horizontally polarized radiation. For the cross-polarization measurements, the horizontally polarized antenna was used for transmission and the vertically polarized antenna for reception. The antennas were mounted on a servo-controlled platform within a radome on the underside of the C-46 test aircraft. Platform azimuth was adjusted during each run so that the direction of propagation (except for normal incidence) was forward, approximately along the ground track of the aircraft. The platform tilt angle, which determined the radiation incidence angle, was stabilized against aircraft motion about the tilt axis by means of a vertical gyroscope mounted on the platform.

Targets and Backgrounds Observed: wooded land (Connecticut), cultivated land (Virginia), Atlantic Ocean, dry pine forests and grasslands (northern Arizona), irrigated farm land (Chandler, Ariz.), desert and dry lake bed (Amboy, Calif.)

Test Procedure (Property Measured): scattering cross section per unit area

Data

Output form: curves of scattering cross section, 10 log σ_0 vs. incidence angle; curves are averages of several measurements

B-03539. Measurements of Terrain Backscattering with Airborne X-Band Radar (Final Report), Goodyear Aerospace Corp., Litchfield Park, Ariz., 30 September 1959, AD 229 104.

Instrumentation System: airborne side-looking pulsed radar
- Antenna: designed to provide uniform ground illumination angles of incidence from 10^{o} to 70^{o}
- Polarization: horizontal
- Frequency: 9375 MHz (X-band)
- Antenna beamwidths: 4^{o} azimuth, 9.2^{o} elevation
- Pulse-repetition frequency: 800 pps
- Pulse duration: 0.78 μsec
- Transmitter output power: 50 kw

Targets and Backgrounds Observed: wooded land (New Jersey, Connecticut), cultivated land (Virginia), wooded land with occasional residential and cleared areas (Long Island, N. Y.), water (Long Island Sound, N. Y.)

Test Procedure (Property Measured): ratio of received-to-transmitted rf power levels at X-band

Experimental Parameters Specified
- Aspect angle: $10^{o} < \theta < 70^{o}$
- Others: altitude, terrain clearance, slant range

Data
- Output form: tables and curves of backscattering coefficient σ_0 vs. aspect angle
- Data processing: averages, data spread, probability density function for σ_0
- Errors: σ_0 accurate to 1 dB

B-03553. Hagn: An Investigation of the Direct Backscatter of High-Frequency Radio Waves from Land, Sea Water, and Ice Surfaces (Final Report II), Stanford Research Institute, Menlo Park, Calif., May 1962, AD 278 138.

Instrumentation System: airborne high-frequency pulsed radar (a cw mode was also available)
- Antenna: a crossed Yagi array was secured to the nose of the aircraft and a dipole under the tail; the two antennas were matched to have a VSWR of les~ than 1.4:1 when airborne
- Polarization: horizontal, vertical, cross
- Frequency: 32.8 MHz
- Antenna beamwidth
  - Nose antenna vertical: 140^{o} azimuth, 20^{o} elevation
  - Nose antenna horizontal: 50^{o} azimuth, 10^{o} elevation
  - Tail antenna horizontal: 40^{o} azimuth, 5^{o} elevation
- Pulse-repetition frequency: variable from 10 to 10,000 pps
- Pulse duration: variable from 1 μsec to 10 msec
- Transmitter output power: variable from 4 w to 4 kw

Targets and Backgrounds Observed: ocean, polar sea ice, selected land surfaces

Test Procedure (Property Measured): backscatter reflection coefficient as a function of incidence angle

Data
- Output form: plots of backscatter reflection coefficient ρ vs. angle of incidence
- Data processing: averages, data spread computed

B-04333. Grant, Yaplee: Backscattering from Water and Land at Centimeter and Millimeter Wavelengths, Naval Research Laboratory, Washington, D. C., 20 March 1957.

Instrumentation System: 2-antenna, zero-intermediate frequency superheterodyne cw Doppler
Antenna: spun aluminum parabolas
Polarization: vertical
Frequency: 3.2 cm at X-band, 1.25 cm at K-band, 8.6 mm at Q-band
Antenna beamwidth (both azimuth and elevation): 3.1° for X-band; 3.4° for K-band, 2.4° for Q-band
Transmitter: low-power klystron transmitting tubes: 2K25 at X-band. 2K50 at K-band, QK-291 at Q-band

Comments in the water-surface measurements, the difference in frequency between the transmitted and received signals was provided by the Doppler shift due to the motion of the water. The frequency response of the audio amplifier was linear down to 20 Hz. A radial velocity of about 0.6 knot on the X-band system and less than 0.2 knot on the Q-band system was necessary to give a 20-Hz Doppler frequency. Only in the case of extremely calm water were velocities lower than this encountered. For calm water and all the land-terrain measurements the difference in frequency between transmitted and received signals was provided by frequency modulating the klystron transmitter.

Targets and Backgrounds Observed: water surfaces, tree-covered terrain, tall dry weeds, wet terrain covered with tall green weeds or flags, short dry grass, green grass, non-homogeneous terrain

Comments: Water-surface data were taken on the Potomac River Bridge, Newburg, Md., where a catwalk 150 ft high provided an unobstructed view of the water at all angles from normal incidence to the horizon. Terrain data were taken from bridges that had approaches at least 100 ft above relatively flat land. The bridges used were the Neches River Bridge, Port Arthur, Tex., the Huey P. Long Bridge, New Orleans, La., and the Eugene Talmadge Bridge, Savannah, Ga.

Test Procedure (Property Measured): readings of the ratio of received power were made every 5° from 0° to 40° and every 10° from 40° to 80°

Experimental Parameters Specified
Wind velocity: 0-25 knots

Data
Output form: curves of average radar cross section of water or land echo per unit area of surface σ_0 vs. angle of incidence

B-04434. MacDonald, Ament, Ringwalt: Terrain Clutter Measurements, Naval Research Laboratory, Washington, D. C., 21 January 1958, AD 156 184.

Instrumentation System: airborne pulsed radar
Antenna: unspecified
Polarization: horizontal, cross
Frequency: X-band, S-band, L-band
Antenna beamwidth: unspecified
Pulse-repetition frequency: 175 Hz
Pulse duration: 1/2 μsec

Targets and Backgrounds Observed: rural terrain, urban terrain

Test Procedure (Property Measured): radar ground clutter

Experimental Parameters Specified
Altitude: 2000, 3000, 6000 ft
Depression angle: $1.5° < \theta < 90°$
Aircraft ground speed: 140 knots
Date: February 1956
Location: Annapolis, Baltimore (Md.)

Data
Output form: charts of normalized radar cross section (dB), 10 log σ_0 vs. depression angle

B-04435. Peake, Taylor: Radar Back-Scattering Measurements from "Moon-Like" Surfaces, Antenna Laboratory, Ohio State University Research Foundation, Columbus, 1 May 1963.

Instrumentation System: single-antenna cw Doppler

Antenna: high-gain pyramidal horns and zoned dielectric lenses designed to give an optimum pattern at operating range of 20 ft

Polarization: horizontal, vertical

Frequency: 10 GHz at X-band, 15.5 GHz at K_u-band, 35 GHz at K_a-band

Transmitter: low-power klystrons, X-12 at X-band and K_u-band, QK-291 at K_a-band

Detector: 1N23 crystals at X-band, 1N26 crystals at K_u-band, 1N53 crystals at K_a-band

Targets and Backgrounds Observed: sand, gravel, stone

Test Procedure (Property Measured): radar backscatter (dB)

Data

Output form: curves of radar backscatter vs. grazing angles of 20^o to 80^o

Data processing: curves of radar return, $10 \log \gamma$ vs. normalized roughness

B-04436. Cosgriff, Peake, Taylor: Terrain Scattering Properties for Sensor System Design: Terrain Handbook No. 2, sponsored by contracts between U. S. Air Force (ARDC) and U. S. Army Signal Corps and Ohio State University Research Foundation, Columbus, May 1960.

Instrumentation System: single-antenna cw Doppler

Antenna: high-gain pyramidal horns with zoned dielectric lenses designed to give an optimum pattern at operating range of 20 ft

Polarization: horizontal, vertical

Frequency: 10 GHz at X-band, 15.5 GHz at K_u-band, 35 GHz at K_a-band

Transmitter: low-power klystrons, X-13 at X-band, X-12 at K_u-band, QK-291 at K_a-band

Detector: 1N23 crystals at X-band, 1N26 crystals at K_u-band, 1N53 crystals at K_a-band

Targets and Backgrounds Observed: smooth terrain, vegetation, snow- and rain-covered terrain, sea

Test Procedure (Property Measured): radar cross section per unit area of terrain (normalized echo area)

Experimental Parameters Specified

Incidence angle: measurements made at 5^o or 10^o intervals for incidence angles from 10^o to 80^o ($\pm 1^o$)

Slant range: 20 ft

Effective illuminated area (normal to line of sight): 2.41 ft^2 at X-band, 2.36 ft^2 at K_u-band, 0.67 ft^2 at K_a-band

Data

Output form: curves of radar cross section per unit area of terrain vs. angle of incidence and frequency

Error: measurements accurate to ±1 dB

Insert Radar Data Sheets Here

6
PASSIVE MICROWAVE DATA

The passive microwave data in this compilation are apparent temperatures (antenna or target) as a function of aspect or depression angle. These data are processed in a manner similar to that used for the optical data in section 3, i.e., each curve is digitized and assigned subject codes (table 1-1), and the parameter information describing the experimental conditions (see table 6-1) is listed. However, the system used to process the microwave data is actually an expanded version of that used with the optical data. It has been designed to handle not only passive microwave data, but also, eventually, both directional and bidirectional reflectance data. Thus, many of the parameters defined in table 6-1 do not apply to the data now in this section, but were included for future data accessions.

There is also a major difference in printed-out format between the curve headers for the optical data and those for the microwave data in this section. For the optical data, all the parameter designations are printed as part of each header whether or not there is specific information on the parameter. For the microwave data, only those parameters for which there are specific entries will appear; parameters that are not applicable or not specified are not included. The data are arranged by subject codes and alphabetically cross-indexed in section 2.

TABLE 6-1. GENERALIZED PARAMETERS FOR PASSIVE MICROWAVE DATA

	TIME
MONTH	Month of measurement
DAY	Day of measurement
YEAR	Year of measurement
TIME	Time of measurement (24-hour clock), Greenwich Standard Time (GMT)
	TARGET
LAT	Latitude (degrees) of measurement (field measurement) or of location at which specimen was collected (laboratory measurement)
LATNS	Latitude, North (N) or South (S)
LONG	Longitude (degrees) of measurement or of location at which specimen was collected, as with LAT
LONG EW	Longitude, East (E) or West (W)
TARALT	Altitude of target above ground (kilometers)
TARZEN	Zenith angle (degrees) of target normal with respect to vertical
TARAZ	Azimuth angle (degrees) of target normal with respect to a $\phi = 0$ reference line defined for a given target
TARUNF	Surface uniformity coded as UNIFRM (uniform) or NONUNF (nonuniform); in radar applications, use subject codes from table 1-1 or the Douglas Sea Scale codes (table 5-2).
TAROPQ	Target opaqueness coded as OPAQUE (opaque), TRANSP (transparent), or TRANSL (translucent)
TARTEM	Target temperature (degrees Kelvin)
TH2OES	Qualitative estimate of free water content coded as DRY, DAMP, WET or PTFL (partially flooded). Indicate snow under TARCS1 or TARCS2.

TABLE 6-1. GENERALIZED (PASSIVE MICROWAVE) DATA PARAMETERS (Continued)

TH2OME	Quantitative measure (percent) of free water content; W indicates percentage by weight, V percentage by volume
HRSREM	Number of hours sample has been removed from its natural environment
TARCS1	Target coating or substrate 1 coded using up to a five-letter code from the Target Signature Subject-Code List (table 1-1) preceded by a C (coating) or S (substrate); snow coatings are indicated using the following letter code at the end of subject code BHBD: A Incomplete cover B Depth 0 to 5 cm C Depth 5 to 20 cm D Depth over 20 cm
TARCS2	Target coating or substrate 2 (see TARSC1)
TARCON	Target contaminant coded using up to a six-letter subject code from table 1-1
TARSRD	Availability of data on the target's surface roughness, coded by AVAIL
TARDCN	Availability of the target's dielectric constant, coded by DC; its index of refraction, coded by N; or both, coded by BOTH
TARINF	Availability of other descriptive information about the target, coded by AVAIL

BACKGROUND

BKGTYP	Predominant background type coded using up to a six-letter subject code from table 1-1
BKGUNF	Background uniformity (see TARUNF)
BKGOPQ	Background opaqueness (see TAROPQ)
BKGTEM	Background temperature (see TARTEM)
BH2OES	Qualitative estimate of free water content (see TH2OES)
BH2OME	Quantitative measure of free water content (see TH2OME)
BKGCS1	Background coating or substrate 1 (see TARCS1)
BKGCS2	Background coating or substrate 2 (see TARCS2)
BKGCON	Background contaminant (see TARCON)
BKGSRD	Availability of data on the background's surface roughness (see TARSRD)
BKGDCN	Availability of the backgrounds dielectric constant, index of refraction, or both (see TARDCN)
BKGINF	Availability of other descriptive information about the background (see TARINF)

METEOROLOGY

Note: These parameters are applicable to field experiments only.

AIRTEM	Ambient or air temperature (^{o}K)
BARPRS	Barometric pressure (millibars)
RELHUM	Relative humidity
VISBIL	Visibility (kilometers)
WINDSP	Wind speed (miles per hour)
WINDIR	Wind direction (N, NNE, NE, ENE, etc.); for radar, indicate relative bearing with 0^{o} being from target to receiver and angle measured counterclockwise
OBST	Obstructions in the air preventing a clear view of the target, coded as NONE, FOG, DRIZZL, RAIN, SNOW, HAZE, SMOKE, DUST, or OTHER
PRAMT	Ground accumulation of precipitation in the preceding 24-hour period (centimeters)
CLDCOV	Total cloud cover (percent)

TABLE 6-1. GENERALIZED (PASSIVE MICROWAVE) DATA PARAMETERS (Concluded)

SOURCE

Note: These parameters are not applicable to passive-microwave measurement systems.

SORTYP	Type of source coded using table 1-1
SGAMMA	The real part of the coherence function of the source, i.e., the visibility function or $\lvert\gamma_0\rvert$; for radar, 1.0 = coherent, 0.0 = noncoherent
SORPOL	Type of source polarization coded using table 1-1
SORDP	Degree of polarization at the source (percent)
ZENINC	Zenith angle of incidence (degrees)
AZINC	Azimuth angle of incidence (degrees)
SRANGE	Range (distance) from source to target (kilometers)
SORINF	Availability of other descriptive information about the source, coded by AVAIL

RECEIVER

MINST	Measuring instrument coded using table 1-1
ROMEGA	Mean reflected solid angle (steradians)
RRANGE	Range from target to receiver (kilometers)
ZENOBS	Zenith angle of observation (degrees)
AZOBS	Azimuth angle of observation (degrees)
RECPOL	Type of receiver polarization coded using table 1-1
LAMDA	Operating center wavelength λ_c (centimeters)
IFBAND	Intermediate frequency bandwidth or spectral resolution expressed as $\Delta\lambda/\lambda_c$
TIMEC	Time constant for integration time of the receiver (seconds)
INSENS	Availability of data on instrument sensitivity, coded by AVAIL
SYSACC	System accuracy expressed in units of the dependent variable
ANT3DB	3-db antenna beamwidth (degrees)
AVESLL	Average side-lobe level of the antenna (decibels)
RECINF	Availability of other descriptive information about the receiver, coded by AVAIL

GENERAL

PLATF	Experimental platform coded using table 1-1
RELABS*	Dependent variable is indicated as relative (REL) or absolute (ABS)
STAND	Standard used coded using table 1-1
NAVE	Number of curves or measurements averaged to make up this curve
VARNCE	Variance about curves in units of ordinate dimensions

*If ABS (absolute) appears along with an entry for STAND (standard), the measurement was originally done on a relative basis using the indicated standard and later converted to absolute values.

Insert Passive Microwave Data Sheets Here

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13. ABSTRACT

This supplement to the Target Signature Analysis Center: Data Compilation augments an ordered, indexed compilation of reflectances, radar cross sections, and apparent temperatures of target and background materials. The Data Compilation includes spectral reflectances and transmittances in the optical region from 0.3 to 15 μ and normalized radar cross sections (active) and apparent temperatures (passive), plotted as functions of aspect or depression angle, at millimeter wavelengths. When available, the experimental parameters associated with each curve are listed to provide the user with a description of the important experimental conditions.

This supplement contains the initial addition of reflectance distribution function data to the unclassified compilation. The data are presented in tabular form as a function of reflection angle for fixed incidence angles and discrete wavelengths in the visible and near-infrared spectral regions. These data were obtained from the Laboratory Measurements Phase of the Target Signature Measurements Program conducted at The University of Michigan and sponsored by the Air Force Avionics Laboratory. The unclassified compilation, including these data, consists of about 4300 curves and 112 tables (in general, each table is the equivalent of four unique curves).

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